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[OFFICIAL NOTICE.]

Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., April 28, 1890.

The Thirteenth Annual Meeting of the Western Gas Association will be held at the Lindell Hotel, St. Louis, Mo., on the 21st, 22d and 23d days of May. The hall in which the business sessions of the Association will be conducted is within the hotel building, is very commodious, quiet, and in every way excellently well adapted to our requirements. The hotel management has granted on this occasion the following rates: For single room and board, $2.75 per day; for room with bath, $3.25 per day. These rates will apply to members in attendance, their families and visiting brethren. In this connection I am instructed by the Local Committee of Arrangements to give our members warning of the fact that in order to secure suitable accommodations, their rooms *must be engaged in advance.* Your Secretary has been in the habit of making an announcement to this effect with exceeding regularity from year to year, and just as regularly no one, or at least only very few, pays the slightest attention to the warning. The necessity of engaging quarters in advance, however, is in this instance very urgent. Now that the old Planters' House has been closed, the Southern and Lindell Hotels often have more business thrust upon them than they are capable of handling, and of late it has been no unusual occurrence for them to deny would-be guests admission, unless their rooms had been previously spoken for. But all of our members can be accommodated without the slightest jar or friction, if they will but take the trouble to address a line to the "Proprietor of the Lindell Hotel, St. Louis, Mo.," telling him the kind and price of room or rooms desired. This should be done at least one week in advance of the first day of the meeting.

In addition to the reduction in transportation rates granted by the Central Traffic Association, the Trunk Line Association has also joined in the movement. As the boundary of the latter Association extends as far east as the western border of the New England States, our Eastern friends will be enabled to avail themselves of the reduced fares.

I am authorized to state that Mr. R. D. Walsh, Chairman of the Local Committee of Arrangements, has kindly consented to take charge of all articles destined for the Gas Exhibit, and will cheerfully surrender a generous portion of his time to the interests of exhibitors. Communications, consignments of gas stoves, apparatus, burners—anything, in fact, intended for the Exhibit—may be directed to Mr. Walsh, in care of the Laclede Gas Light and Coke Company. Exhibitors can rest assured that not only will their wares receive careful handling and be displayed to the best possible advantage, but that they themselves will be accorded the most courteous treatment at the hands of Mr. Walsh and his efficient committee.

The "Paper List" for our Thirteenth Annual will be as follows:

"Relative Value of Gaseous Fuels," by B. E. Chollar.

"Effects of Natural Gas Competition," by James Somerville.

"An Argument in Favor of the Adoption of a Uniform System of Estimating the Cost of Gas in the Holder," by George G. Ramsdell.

"Impressions of British Gas Works," by George T. Thompson.

"Mixed Gases," by E. G. Cowdery.

"Wrought Iron, Cast Iron, or Steel—which is the Best Material for Street Mains?" by Eugene Printz.

"What Policy Should the Gas Interest Adopt in Connection with the Approaching World's Fair?" by Walton Clark.

"On the Abuse of the Patent System as Bearing on the Gas Industry, with a Remedy," by Frederic Egner.

"The By-Products of Experience," by Allen R. Foote.

The attention of the Board of Directors is called to the fact that Section I., of Article VII., of our By-Laws reads as follows: "The Board of Directors shall meet as such at least once in each year, on the day preceding the annual meeting of the Association, at which time they shall determine in regard to the propriety of the various papers, drawings, models, or other matters constituting the special order, being laid before the Association." The Board of Directors elected at our last meeting is composed of the following-named gentlemen, who are, therefore, particularly requested to assemble at the Association's headquarters on Tuesday morning, May 20, at 10 o'clock:

J. B. Howard, E. H. Jenkins, Z. T. F. Runner, John Gimper, C. W. Butterworth, E. G. Cowdery, Jr. S. Ambrose, J. W. Dunbar, and B. E. Chollar.

Application blanks, copies of our By-Laws, and any information not contained in these communications will be cheerfully furnished by

A. W. Littleton, Sec'y.

BRIEFLY TOLD.

The Paper List for the St. Louis Convention.—A glance over the list of papers that are to be presented at the meeting of the Western Gas Association is all that is necessary to force the conviction that the literary part of the proceedings will be more than ordinarily interesting, which is high praise when one bears in mind the always excellent contributions that the Western has been favored with. First on the list comes Mr. Chollar's name, who proposes to deal with the "Relative Value of Gaseous Fuels." Now, it must be admitted that Chollar has a peculiarly attractive method in his penciling, and when the fruit from the latter has been turned out of the basket it cannot be charged with the taint of unsoundness. His subject is one that is in full accord with the thought of to-day, and as he has neither a process to sell nor a pet theory to propel, we can safely count on true independence of opinion from him. Mr. Jas. Somerville will also be welcomed again with heartiness to the arena of disquisition, the records of which bear ample testimony to his carefulness and thoroughness. Next we have Geo. G. Ramsdell, who has in other days—and not so long ago, either—proved his value in the field of argument. His subject, too, is one that bears the charm of novelty. We hoped some time ago that Mr. Thompson would have, through the columns of the Journal, given our readers the benefit of his "Impressions," but, it is without any symptoms whatever of jealousy, that we congratulate the Western on being the first to have an itemized account of the Thompson tour through Europe. If we mistake not, this is Mr. Cowdery's "first appearance" as a paper contributor, and as he is well grounded in his subject, through careful, prolonged and extensive practice at Milwaukee, we confidently look forward to an excellent paper from him. Mr. Eugene Printz will beyond doubt show to good advantage in the matter of determining which is the best iron material for use in street mains, and Mr. Clark will, we imagine, have something original to suggest in his remarks on the correct attitude to be assumed by the gas interest in respect to its connection with the World's Fair. Mr. Egner's name is so familiar to our readers, that no doubt they are at one with us in the knowledge that he could not write uninterestingly even did he try to so do. Mr. Foote closes, and with seeming appropriateness, a list that is headed by a C(h)ollar. Take it in any light, one cannot avoid the conclusion that the meeting at St. Louis is to be enlivened by an excellent lot of papers on subjects well outside the usual scope, that are to be prepared by authors of unexceptional capacity.

The Gas Apparatus Exhibit at St. Louis.—Messrs. Walsh and Egner of St. Louis, are devoting much attention to the matter of arranging for the exhibition of gas appliances that is to form a prominent feature of the Western's meeting. We can only repeat our hope formerly expressed that every one of our advertisers will be represented in the display; and to give the matter as wide publicity as possible, we herewith reprint a circular, dated from the Engineer's office of the Laclede Gas Light Company, on April 29th. The circular reads:

"*To Manufacturers of Gas Appliances.*—It is the intention of the local Committee of Arrangements of the Western Gas Association to have, in connection with the annual meeting, an exhibition of gas appliances. Mr. Emerson McMillin, President of the Laclede Gas Light Company, has kindly given the use of the third floor of the large new office building of that Company to the Committee for an exhibition hall. The same is supplied with freight and passenger elevators, gas, water and closets. Exhibitors will be under no expense whatever, except that of sending and removing their exhibits. It is not necessary to remove exhibits as soon as the convention is over. On the contrary, exhibitors may continue to show their goods at the hall to the public or customers, or sell them from the hall, or use the exhibits as samples merely, for an indefinite time, and remove whatever they desire to take away at their leisure and convenience. The hall is located in the center of the business districts of the city of St. Louis—a city of over one-half million of inhabitants; a city as large as New York city of 30 years ago; a city which is the visiting point annually of many thousands of people from Mexico to the Canadas, the Pacific coast and the Gulf. It is not the unimportant border town that many Eastern people who have never been here seem to imagine. This opportunity to exhibit during the convention, and more or less permanently after that time, should not be neglected by manufacturers. Those not represented may regret it when too late. Such as wish to exhibit should address, without delay, the undersigned, and send on their goods, so as to be sure and have them in place on May 20th, next.—Very respectfully, Frederic Egner."

A Correction.—In Mr. B. E. Chollar's paper in the Journal (April 7, p. 485), entitled "Doubts versus Dogmatism," some inexcusable typographical errors occur; and as the admission is made that they are inexcusable, we have but to point them out and correct them. In the eighth paragraph, which is chiefly devoted to an explanation of the diagram accompanying the paper, the words "wave point" occur four times. In each instance these should read "wave front."

Notes.—We are in receipt of telegraphic advices from Providence, R. I., which are to the effect that the Wakefield Manufacturing Company's "little bill" has been indefinitely postponed by the Rhode Island Senate, and we are glad of it.——There can be little doubt that important changes will soon be perfected in the capitalization and scope of the United Gas Improvement Company. As we understand it the capital is to be increased to $50,000,000, about 50 per cent. of which is to be held in England. The Company will largely extend its business. ——The municipal gas works for Hamilton, Ohio, are virtually completed.——Important plant betterments are being made at the gas and electric lighting stations of the Neenah and Menasha (Wis.) Gas and Electric Light Company.——The Pratt and Ryan Water Gas Construction Company, with a capital of $100,000, has been incorporated with place of business at Chicago. That is a reconstruction of the old firm of Henry C. Pratt and Co.——The Fresno *Republican*, of Fresno, Cal., is making a great howl over the imperfect burners maintained in the public lamps, and thinks the Gas Company ought to change them. Why should the authorities not attend to it? It is their duty to do so.——The strike at the Elizabeth (N. J.) gas works was a complete failure. The men were "out" 3 days, and were glad to get back on the old terms.——Mr. Frank Seaverns, of Perkins & Co., will sail for Paris on the 10th inst. No pleasure trip for Frank this time ——The proprietors of the Watkins (N. Y.) Gas Company have reduced the selling rate to $2.25 per 1,000. Former price, $2.75.——The San Diego (Cal.) Gas and Electric Light Company has adopted a novel plan to head off competition. Briefly stated the scheme is this: the Company agrees to reduce the price of gas to $2.50 from $3.50 per 1,000, provided the consumer will sign a contract to take gas from no other Company for the period of 5 years. The agreement also provides that if during the five years the City Council shall pass, and the Gas Company accept any ordinance by virtue of which the price of gas to all private consumers is reduced below the price named in the agreement, then consumers shall not be required to pay any price in excess of that named in the ordinance, but shall have the benefit of any general reduction in price which may be made.

The Market for Gas Securities.

Consolidated sold above 99½ during the week, and to-day (noon, Friday) is bid for at 99. Prudent observers of the market and careful investors look for 105 before July 1st. Of course, dividend time is approaching, and the shares are carrying the earnings virtually for the old months. Other city shares show no marked change. Brooklyn shares are strong, the highest figures for years being now recorded in one or two of them. Chicago Trusts are up to 51¾–52, and Chicago gas, the successor to the Trust, ought to sell at 60 before July 1st. The general market presents no feature of interest, other than that a good demand for shares is certain.

[A Paper read before the Society of Gas Lighting.]

Labor-Saving Appliances for the Manufacture of Coal Gas.

By Mr. Wm. Mooney, C.E.

Assuming at the outset that coal will be used for the manufacture of illuminating and fuel gas for many years to come, and that the present methods of purification will also continue in use for some time yet, I venture in this paper to call attention to the use of labor-saving appliances in the handling of the coal, coke and purifying materials.

I am aware of the fact that one not actually engaged in gas making is apt to suggest improvements, so-called, that the practical engineer at first thought may not think of much value; but these notes may encourage thought in the direction, now so earnestly sought, of cheapening the cost of manufacture, and thereby reducing the cost of gas to the consumer, and encouraging him to use it for other purposes than illumination.

The subject treated of in this paper might properly be called the substitution of machinery for hand labor in the manufacture of gas; and the subject may be divided into the following parts:

1st.—Handling and storage of coal.
2d.—Delivery of the same in the retort house.
3d.—Charging and drawing the retorts.
4th.—Handling and storage of coke.
5th.—Handling of purifying materials—lime and oxide of iron.

That the methods of manufacture used in the manufacture of coal gas are a fit subject for improvement nobody can deny, some of the methods being as old as the business itself.

Improvements, it is true, have been made on certain lines and the cost of manufacture reduced; but these improvements only show more plainly the need of radical changes. For obvious reasons the changes suggested here can apply only to large or medium-sized works.

Handling and Storage of Coal.—Economy in this line has always been a study by engineers and others, and while considerable progress has been made in economical handling and storing, yet there is still room for improvement.

Works that have been badly located, without much thought as to the coal supply, or future growth, thus putting a tax on the manufacture for all time, and saving possibly a trifle in the first cost of the land, can do but little towards economy in the direction indicated above; but improvements, to some extent, can be made almost anywhere.

The inventions of Mr. C. W. Hunt, in apparatus for the handling of coal, have simplified to a wonderful extent the old methods, and the increased amount of coal delivered per man has been as ten to one, with less strain on the laboring man.

The cable system adopted some years ago by the Manhattan Gas Light Company, of New York, and still in use for out-door storage, seems to be simple in its working and a great saving over the old systems.

The only suggestions to be made for improved methods under this heading are the use of link belt elevators and conveyers, which are used with great success in handling anthracite coal. It is probable that gas coals will in time be unloaded from vessels and carried horizontally to the storage piles by means of bucket elevators and conveyers as grain is handled at present.

Delivery of Coal to the Retort House.—This subject is more or less closely allied to the previous one, and in many cases is a part of the same system. At the works of the Newark Gas Light Company the coal is hoisted from the vessel, by the Hunt system, to an elevated hopper, from which it is delivered into cars, from which it is dumped either into bins inside of the retort house, or delivered into the coal sheds through openings in the roof. A platform elevator raises the cars when coal is to be carried from the coal shed to the retort house. Where charging machines are used the coal is also raised in cars on platform elevators. It is possible that, where the coal shed and retort house are properly located, the platform elevator will in time be superseded by the bucket elevator, and the cars will give way to the horizontal conveyer.

Charging and Drawing Retorts.—In this branch of the manufacture of coal gas the whole system is at fault. The horizontal retort is substantially the same as it was at the inception of the business. Whether the lately introduced inclined retort will be a success remains for the future to decide.

The carbonization of coal by the cupola system has never had a fair and thorough test. The many patents covering this system all seem to lie dormant, and perhaps, when some of them have expired, some further experiments may be made in this direction. There are no really formidable obstacles in the way that may not be overcome by patient experiment combined with a liberal expenditure of money.

When coal can be carbonized in cupolas by a continuous process coal gas can be made cheaper than by the intermittent water gas processes. At the same time, the coal gas can be enriched by naphtha or oil without any special apparatus. However, as horizontal retorts are likely to be used for an indefinite time, improvements in the manner of drawing and charging them are still in order.

The stoking machines invented by Capt. A. Q. Ross have taken the lead, in this country at least, and are without doubt, since recent improvements, as perfect machines for the purpose as can be devised. It is hoped that some simple machine may yet be devised which can be made cheap enough to warrant its use by small companies. No suggestions for improvements in this department are made, and probably no changes will be made, except the radical change to the cupola system, as noted above. The many improvements due to the introduction of so-called regenerative furnaces do not properly come within the scope of this paper.

Handling and Storage of Coke.—Much attention has of late been paid to the proper treatment of this valuable bye-product, and the sales to private consumers have been increased by proper crushing and screening. The care of the salable coke is of great importance, and there is room for improvement in this direction. The quenching of coke in barrows, while accomplished in one place, is unsuccessful in others, the barrows being most of the time in the repair shop.

Different places seem to require different treatment of coke to make it salable. In one place it must be crushed and screened, while in another it is simply screened by the screening shovels.

At the Milwaukee (Wis.) gas works a system of coke handling has been introduced which seems to be a step in the right direction. The entire product of coke is removed from the retort house cellar entirely by machinery.

The coke falls from the mouthpieces, through the usual apertures in the floor, into conveyers, which travel at a short distance below the iron floor. At the end of the range the coke drops into conveyers of larger size, which carry the coke to the outside of the building, where it is quenched by water from a perforated pipe extending over the conveyer.

By means of a bucket elevator the coke is then elevated and piled, and the only men employed are the engineer who runs the engine, and one man who attends the swivel spout at the top of elevator.

A horizontal conveyer running under the coke pile conveys the coke to another elevator which delivers it to a series of fixed screens, which deliver the different sizes into pockets, from which it is drawn, as wanted, into the delivery carts.

Where four different sizes of coke can be sold or used a revolving screen is found to work well; the coke being crushed in the usual crusher, and the different sizes, viz., broken, screened, pea and breeze, delivered from the screen into separate pockets ready for delivery into carts.

The whole of the coke handling machinery at Milwaukee is moved by a 50-horse engine.

Handling of Purifying Material, Lime and Iron.—Having lately designed a purifying house for a works where they proposed using all means possible for the economical handling of material, a brief description of the same will be given. As a preliminary to making the drawings, a visit was made to one of the most extensive and complete breweries in the city of New York—not, however, for bibulous purposes, but to inspect the manner of handling automatically the materials used in that special business.

It was found that the entire moving of the grain and malt both before and after using was done by machinery. All upward and downward movements are performed by bucket elevators and shoots, and all lateral movements are, with one exception, made with screw conveyers—the exception noted being the spreading of grain on floors to dry, which is done by means of iron buckets travelling on an overhead railway.

It is but natural to suppose that if the materials used in gas works had to be moved to as great a height as the brewers' materials are we should have adopted their methods long ago.

In the purifying house alluded to it was proposed to place the four boxes (which were 24 by 30 by 5 feet deep) in a square in the usual manner, although they were to be operated by a valve system, which would have worked them to advantage placed in line. Directly over the center of each pair of boxes an iron lattice girder was placed, at the proper height to clear the carriages. To the centers of each of these girders were attached the wheels carrying the elevators, which worked inside of an iron enclosure between floor and girder, and a brick enclosure in cellar. The fresh oxide was received at the top into a hopper, and carried to the boxes on each side by screw-conveyers. These conveyers terminated over the center of each box with swivel pipes, by which the material could be spread over the outside surface of box.

The conveyers, which were continuous steel screws, about 12 in. in diameter, were driven by suitable shafting and gearing secured to the girders, and driven by an engine in an adjoining building. The elevator was kept supplied by barrows emptying the revivified material into the boot or hopper at bottom. The foul oxide was dropped into the basement, through suitable openings in the bottom of boxes, which were secured by lids with cotter bars and screws, closing them gas tight.

It was proposed to spread the material over the concrete floor of basement by manual labor, using the basement for a revivifying room.

At the East End station of the Cincinnati Gas Light and Coke Company the revivifying floor is located at the end of the purifying room, and the floor is about one foot higher than the top of the boxes. A platform on wheels, running on tracks laid on the floor of purifying room, extends over each box, by means of which the material is brought in barrows and placed in any part of the box.

The foul material is dumped through openings in the bottom of boxes, and is taken up to the revivifying room by platform elevators.

The following suggestions for improved methods may or may not be practicable, but are here given for what value they may have:

The purifying house to have a high and well ventilated and lighted basement, with room for clear passage under the connecting pipes. Directly under each purifier are hoppers to receive the foul material, which is carried by conveyers to belt elevators against the side walls, and thence to the revivifying room, which will be located directly over the purifiers. This room might be suspended from the roof trusses or supported on columns and girders. It would have large openings on all sides filled with louvres, and the roof will have large ventilators. The belt elevator will deliver the foul material into hoppers, from which it can be spread on the floor, by swivel spouts or by manual labor. In the floor of the room there will be openings directly over the center of each purifier, through which the material can be delivered by swivel pipes to all parts of the boxes.

This arrangement may look, at first sight, more extensive and complicated than it really is, and there is no reason why the purifying material cannot be as easily and cheaply handled as brewer's grains.

Another partial improvement, where the basement under the purifiers is used for a revivifying room, and the fresh material raised by platform elevators, may be suggested as follows:

The trays, instead of being supported on bearing bars, to rest on spindles at the corners with dowels and corresponding holes in the trays; the trays to be made smaller than usual. In emptying the box, after breaking down and opening the doors in the bottom, which would be a little larger than usual, the whole contents of the box—oxide, trays and spindles—would be dumped into the room below, the trays and spindles, after cleaning, to be brought up in barrows on the platform elevators.

Bucket elevators and screw conveyers are no new things, both being found in the most ancient grist mills, the primitive screw conveyers being made with wooden pins inserted into a wooden shaft.

The whole outfit of link-belt elevators, horizontal conveyers of different kinds, swivel pipes, and, in fact, the whole apparatus for moving or raising any material, can be obtained and their erection contracted for by well-known establishments, eager to introduce their systems into any new industry.

If any of the suggestions contained in this paper appear to be too radical, it must be remembered that the radical is generally the pioneer or leader (sometimes too far ahead of the times, at which period he is called a crank), but generally not far in advance of the practical man who reaps the crop, the seed of which was sown by his radical predecessor.

Jones' Safety Device for Gas or Air Pipes.

U. S. Letters Patent (No. 424,305) were granted, on March 25, to Edward C. Jones, of Boston, Mass., for "new and useful improvements in safety devices for gas and air pipes." Reproducing the language of the specification, the inventor says:

This invention relates to improvements in safety devices for gas or air pipes; and its object is to prevent explosions of illuminating, producer or heating gases when accidentally mixed with atmospheric air while being conveyed from the gas works to the holder or consumer.

Producer gas for heating purposes, when mixed with a small quantity of atmospheric air, forms a very explosive compound when brought in contact with a light or fire, and when a leak occurs in the pipe a very dangerous accident may happen, causing injury to the pipes or their surroundings if the escaping gas is ignited.

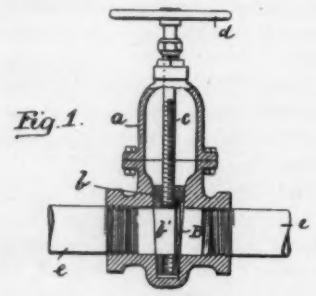
The invention, although particularly designed for preventing explosions in producer gas pipes, is also very well adapted for blast pipes of water gas generators for the purpose of preventing the gas from the generator from backing into the blast air-pipe and exploding the compound gas.

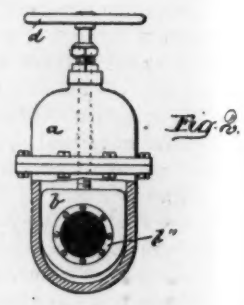
In fact the invention is useful for any and all purposes where there is any danger of explosions from illuminating or heating gases being mixed with atmospheric air in the right proportion for causing an explosion when brought in contact with a fire.

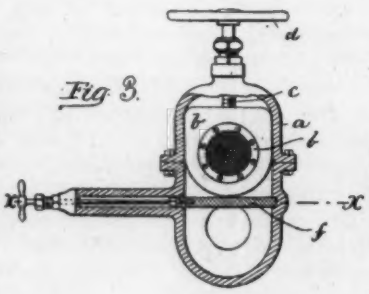
The invention is constructed as follows, reference being had to the accompanying drawings, where—

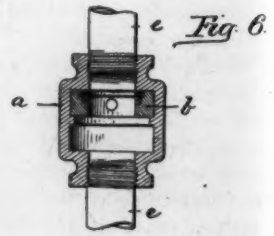
Fig. 1 represents a vertical section of a valve provided with my improved safety device. Fig. 2 represents an end view of the same, parts of which are shown in section. Fig 3 represents a modification of the device, showing, in connection with the safety-plug, a cut-off or slide arranged at a right angle to said plug for the purpose of allowing the safety-plug to be cleaned or repaired without shutting off the gas supply from the pipes. Fig. 4 represents a horizontal section on the line *XX* (shown in Fig. 3). Fig. 5 represents an end view and partial section of a modification, showing a pair of safety plugs arranged side by side within the valve chest for the purpose of substituting one plug for the other in case the plug in use should become foul or clogged up; and Fig. 6 represents a cross section on the line *Y Y* in Fig. 5.

Similar letters refer to similar parts wherever they occur on the different parts of the drawings.









a represents a valve-shell of any well-known form or construction, having on its interior seats against which a vertically sliding plug *b* is adapted to be lowered by means of a screw shaft *c* and hand wheel *d*, and which is also adapted to be raised out of the way, for a purpose hereinafter specified. I do not, however, limit myself to any particular means for lowering and raising the valve, as it will be obvious that other means may be employed. *e e* represent the gas-supply pipes as usual connected in a suitable manner to the ends or flanges of the valve shell. The plug *b* has a transverse perforation *b'*, of a size about equal to the interior bore of the pipes *e*, which perforation coincides with the pipes *e e* when the plug *b* is closed against its seat, as shown in Figs. 1 and 2. The said perforation is covered by a fine wire gauze or netting *B*, which is preferably secured to said plug by means of a ring *b''* and suitable fastening screws, as shown in Fig. 2; but this is not essential, as said wire gauze or netting may be secured

to the plug for the purpose of covering its perforations in any other suitable or equivalent manner.

It is well known that wire gauze or netting serves as a means to prevent explosion of gases from passing by such wire sceeen, and thus it will be seen by the arrangement, as shown and described, an explosion of gas taking place from any cause on one side of the valve and its wire gauze or netting will be prevented from going beyond the latter, thus preventing accidents and damage. Should the wire gauze or netting become foul or clogged with impurities, all that is necessary to do is to raise the plug *b*, so as to establish a free passage for the gas through the valve shell until such time when it may be convenient to shut off the gas pressure for the purpose of cleaning the plug screen or replacing it with a fresh one, as the case may demand.

The modification shown in Figs. 5 and 6 is substantially like the one shown in Figs. 1 and 2, with the difference that in the said Figs. 5 and 6 I have shown the valve shell provided with two plugs of the kind described, instead of one only, as shown in Figs. 1 and 2, each of said plugs being operated independent of the other to enable one to be used at a time, the other one being raised out of position, as shown.

When one plug becomes foul or clogged the other one is forced against its seat and the first one raised out of position, thus enabling the safety device to be used a longer time as compared with the device shown in Figs. 1 and 2, where only one plug and netting is shown.

In Figs. 3 and 4 the device is substantially like that shown in Figs. 1 and 2, with the addition of a solid gate or cut-off *f*, arranged at a right angle to the perforated plug *b*, so as to permit the latter to be raised, when foul or clogged, to the position shown in Fig. 3, after which the horizontal gate *f* is closed, as shown, enabling the operator to remove the top of the valve-shell above the gate *f*, as well as the plug *b*, for the purpose of cleaning the wire gauze or netting *B* without the need of shutting off the gas supply from the pipes *e e*.

Profit Sharing.

In view of the impending labor troubles in this country we are of the opinion that the following, from a paper read by Mr. G. P. Norton before the Liverpool Chartered Accountants' Association, will be read with interest:

Profit sharing will ultimately stand or fall by its own merits, whatever may be our attitude toward it. Amongst the many theories propounded to solve the great labor problem it bids fair at an early date to take a prominent place. The "bonus scheme" of Mr. Livesey at the South Metropolitan gas works has forced it to the front as a prime factor in the controversy. The example of the great London dock strike, combined with the general revival of trade, has awakened the old cry for less work and more wages into such clamorous and persistent energy that just at present more than ordinary efforts are required either to stifle or satisfy. The time-worn dispute seems to be at length resolving itself into a question to what degree it is possible to lessen work and increase wages. Very pertinently Mr. Ruskin's question to the discontented workers comes in: "Do you think the time will ever come for everybody to have *no* work and *all* wages?" It is evident there must be a halting place, and a method of adjustment must be discovered. The problem is undoubtedly one of enormous difficulty, but the time seems ripe for the introduction of any just and effectual scheme.

The rapid progress of the co-operative movement indicates one of the most likely directions in which a permanent settlement will eventually be found; but co-operation leaves the employer out of its plans altogether. For this reason it is not likely to become universal. Account must be taken of the "provision in nature which has made the few strong, wise, and able, and the many weak, foolish, and incompetent." It is desirable, moreover, that those endowed with such superior qualities should have full power to exercise them. The tendency of the English form of co-operation is to reduce all to a dead level—an endeavor after an impossible equality. On the other hand, the employing class has to a large extent forgotten its duties. Instead of regarding trade as a calling, a life's work, what many "want and mean is to make money as fast as possible out of their businesses, and then clear out and turn (so-called) gentlemen." I am afraid this spirit is not altogether absent from the members of our own profession, and the feverish haste to grow rich, at all hazards, has not in a few instances spoiled a promising career and brought about ruin and disgrace.

The co-operative movement could only partially solve the labor problem. Profit sharing between the employer and the employed is closely allied to the principle of co-operation, and in course of time will probably be adopted generally as one of its methods. At present co-operation is an effort of the worker to solve the labor problem in his own way, and chiefly for his own benefit. Profit sharing may become a parallel movement by which the employer will seek to retain the privileges due to mastership, and at the same time secure the goodwill of his workpeople. There is undoubtedly a vast field for the application of profit sharing, providing that it can be shown to be feasible, and an improvement on existing methods. Should it be generally adopted, and there are clear indications of a movement in that direction, the assistance of chartered accountants will be required in a variety of ways. Fortunately a large amount of reliable evidence is available in regard to the experiments already made, which will enable us to judge as to the merits of the various methods under which profit sharing has been worked. It is by no means of modern theory, but rather the outcome of the ancient practice of *product* sharing. In agriculture we find an illustration in the well-known *metayer* system. In the fisheries the "catch," whether good or bad—in many places—has long formed the basis upon which the crew has been paid. In trading ships the sailors have shared the profits of the voyage. In fact, the principle, in different forms, can be traced everywhere, and has been applied to almost every class of undertaking. In course of the development of trade product sharing has, for the most part, fallen into disuse. The division of labor, the difficulty of exchanging the products of labor, and the convenience of payment by a recognized medium of exchange, combined with other causes, have led to the general substitution of the existing wages system. The chief attraction to the worker of payment by wages is that it provides a fixed and certain income, without risk of loss. For this consideration he has forgone his right to participation in profit; and any modification of the system is not likely to succeed, unless this feature is retained. Payment by wages has, however, been tried and found largely wanting, while its particular failings are all absent from the old method of product or profit sharing. In the haste to provide for the exigencies of rapid change and development, the virtue of the old order of things has been lost sight of. Carlyle observes that "The world has been rushing on with such fiery animation to get work, and ever more work, done, it has had no time to think of dividing the wages, and has merely left them to be scrambled for." It is no uncommon thing, however, for old customs to be revived in new shapes, in order to set right prevailing systems which have grown unendurable.

The chief defects of the wages system are that it takes too small account of degree of industry and skill, and it does not offer sufficient inducement for individual effort. "The ordinary employer pays the least he can for labor; and labor, for the most part, gives the least it can in return." Payment by time wages fails notoriously in producing the *quantity* of work of which labor is capable, and the piecework system was introduced to remedy this defect. The remedy, however, produced another evil, for while the quantity was increased the *quality* deteriorated, because of the workers' undue haste and want of care. Quality prizes have been offered and fines for bad work have been imposed, but the difficulty remains; and the expense of supervision is everywhere a subject of complaint. Again, neither piecework nor time wages offers any adequate motive for care and economy in dealing with materials, implements, and machinery. Besides the objections just mentioned, the wages system, as a whole, involves the constant antagonism between employer and employed which finds vent in lockouts and strikes.

Many attempts have been made to perform the work of adjustment with less friction. The sliding scale has been applied, as an automatic regulator, to collieries and mines; but the practical difficulties in the way of working the scale have rendered it, to a large extent, ineffective. Arbitration and the intervention of disinterested parties have done much to make peace, but these remedies ought not to be required. The desideratum, then, it would appear, is a system which will not only remove the antagonism between the employer and the employed, but will make their interests mutual; and so distinctly mutual that the employee shall be able to appreciate the fruits of his extra zeal, skill, carefulness, and economy. The advocates of profit sharing, appealing to the past, as well as to the success of modern experiments, claim that their system answers all requirements. It rewards the worker for his extra exertions, and it gives him a share in the savings effected by his own economy and ingenuity. It is a sliding scale in itself, easily and accurately adjusting the division of fluctuating profits. The claim to these advantages will doubtless be readily allowed, but the manner in which the participation is to be carried out, so as to satisfy both the employer and the employed, requires much consideration.

In the first place, the importance attached by the worker to a fixed and certain payment in wages has already been mentioned; and it is generally agreed that under existing conditions the wages paid should not be less than the regular market rate, the profit sharing being in addition. The next step is to satisfy the employer that his income will not be decreased in order to provide the workers' share of the profits. Now, the strongest argument in favor of profit sharing (assuming that it can be maintained) is that it *creates* the fund which it proposes to distribute.

Mr. Sedley Taylor, in his work on "Profit Sharing," remarks that "the system, far from being a scheme for enriching workmen out of the pockets of the employers, has at its command potential energies capable of opening an entirely new source of profit." That is to say, the zeal of the workmen is aroused, and he puts forth his utmost efforts. There is less waste of time and, therefore, increased production. The cost of superintendence is diminished; for each worker has not only a personal interest in doing his best, but his conduct is under the immediate scrutiny of his fellow-workers, who will lose by his indiligence. The solidarity of interests caused by profit sharing promotes amongst the workers themselves a general surveillance more vigilant and effective than could be obtained from the highest paid overlooker. There is more thrift, more care exercised, and the awakened ingenuity of the worker is brought into full play. Thus, partly earned and partly saved, a fund is raised over and above the ordinary profits, and it is this fund which the worker shares.

An employer contemplating the adoption of the system might be deterred for fear lest, having launched upon a scheme of which he has had no previous experience, he should find it difficult to retrace his steps, if necessary. He may also be reluctant to grant a privilege entailing the possibility of his employees contending for it as a right. The entire control of the whole scheme may, however, be expressly reserved to the employer, with full power either to modify or to discontinue it. The workers' claim to a share in the profits need not receive any legal recognition, and misconduct, or leaving the firm of his own free will, may be made conditions under which his share is wholly forfeited.

The dislike and danger of publicity is another difficulty, but this has been overcome in a very simple manner. The employer privately determines a minimum of profits, after exceeding which he agrees that participation shall commence. This minimum, called a "reserve limit," is revealed to a chartered accountant, who vouches the workers' share. The participation may be regulated by varying percentages (for instance, on the first £1,000 above the "reserved limit" the workers may have, say, 33 per cent., and on the second £1,000, 25 per cent., and so on). It will be necessary for the accountant to have a very clear understanding at the outset, not only of the details of the scheme, but as to the manner of dealing with items in regard to which differences of opinion might be held, as to whether they are chargeable against revenue or capital. The rate chargeable for depreciation, the charge (if any) to be made for proprietor's management, the interest payable upon capital and loans, and the limits within which profits are to be placed to a reserve fund, should especially be settled. In fact every point upon which a conflict of opinion could arise should be guarded by express written instructions. Otherwise it is conceivable, especially where profits are liable to considerable fluctuation, that the accountant's position might often be one of extreme difficulty.

The success of experiments in profit sharing thus far has varied according to the degree of intelligence of the workers. For this and other reasons a partial application and subsequent gradual extension of the principle is often preferable to a full adoption of the system all at once. A nucleus of managers, overlookers, and the *elite* of the workmen being first admitted to participation, the privilege may be extended according to personal merit, length of service, or other qualifications. The *noyau* or nucleus of the *Maison Leclaire* has been an important element in the development of that establishment, and the principle wherever adopted has had an educational and moral influence on the remainder of the workers, which has largely contributed to the success of the system.

Another important factor, applicable to joint-stock concerns, is the gradual acquisition by the employees of a portion of the capital of the business. In many establishments a part of the employees' bonus is retained to be applied in the purchase of shares. The celebrated *Familistere* of Guise, France, the establishment of M. Godin, retains the whole bonus for this purpose, and further provides that the older workmen shall release their shares to the younger, so that the ownership may remain always in the hands of the actual workers. Where it is possible, shares thus acquired should be inalienable and not subject to be charged for debt, voluntary or otherwise.

The schemes upon which the profits are shared vary widely. Some of the French establishments have most elaborate methods of division; such as would, probably, be wholly unsuited to the ordinary English mind. Only a plain scheme, easily comprehended, even though less effective, would be likely to find ready acceptance in England. The methods of participation may be classified under three general heads. (1) Immediate participation; (2) Deferred participation; (3) Mixed participation. In immediate participation the workers' share is paid in cash. In deferred participation the share is retained, and either applied towards the purchase of shares in the capital or passed to the credit of a provident, mutual or pension fund. In mixed participation a part of the workers' share is paid in cash, and the remainder is treated as in deferred participation. The basis upon which the profits are divided is determined by the particular circumstances of each case. Important considerations, such as the relative amount of wages paid compared with the volume of trade done, and the degree in which labor is able to exert its influence on the production, render it impossible to conform to any strict rule. After providing for the reserve fund and a fixed rate of interest on capital, the remaining profits are, in the majority of cases, divided in defined proportions between capital, management and labor. The proportion due to each individual worker is usually based on his wages, but the division in some cases is quite arbitrary; the employer allocating the shares according to his own ideas of merit.

The general introduction of profit sharing into Great Britain has undoubtedly been retarded by the abandonment of the experiments made by Messrs. Briggs & Co., at Whitwood Colleries, Normanton, and by Messrs. Fox, Head & Co., at the Newport Ironworks, Middlesborough. The time at my disposal prohibits the narration of the circumstances which led to the adoption and ultimate abandonment of the system by these firms, but their history has been fully dealt with by Mr. Sedley Taylor, Mr. Gilman, and others. Suffice it to say that both attempts were made at times of bitter antagonism between masters and men, and amongst a class of operatives of low average intelligence. Nevertheless, while the system was in force decided advantages were obtained both by the employers and the employed. The scheme was adopted as an antidote to trade unionism, and it failed because of its being placed in deliberate and unwise opposition to labor organizations. The evidence of these cases is rather in favor of the principle of profit sharing than against it, but the fact of the abandonment has certainly produced a distinctly adverse impression. After a long interval the system appears to have received fresh impulse, and during the past few years, and especially in the past few months, several British firms have announced their intention of admitting their employees to participation. A noteworthy example is that of Wm. Thomson & Sons, Limited, woollen manufacturers, Huddersfield. Mr. Geo. Thomson is a disciple of Mr. Ruskin and an enthusiastic supporter of co-operation. He converted his business in 1886 into an industrial partnership, under which, after charging 5 per cent. upon capital and placing 10 per cent. of the profits to a reserve fund until the fund amounts to 10 per cent. of the capital, the employees are entitled to five-ninths of the net profits. The remaining four-ninths may be applied as the Committee of the Society directs, and have actually been distributed to co-operative societies dealing with the concern, by way of bonus on purchases. The workers' bonus is retained and applied in the purchase of shares in the capital of the business. Mr. Thomson has informed me that "the general result has been most satisfactory upon the work and workers, and that a sense of real fraternity pervades the mills." Messrs. Thos. Bushill & Sons, printers and stationers, of Coventry, who are very active in the support of the system, have introduced profit sharing into their business, which is still carried on under a private partnership. A "reserved limit" has been communicated to a chartered accountant, who certifies the sum due to the workpeople in respect of bonus. The amount of profit made by the firm is thus kept secret. Cassell & Co., Limited, the great publishing house, have introduced a system of deferred participation, as well as methods by which their employees may become shareholders in the capital of the Company. Amongst the remaining British profit sharing firms may be mentioned Blundell, Spence & Co., Limited, color and varnish manufacturers, of Hull, and Tangyes, Limited, engineers, Birmingham.

While the instances of successful profit sharing are sufficient to show that it is a practical scheme, and one under which large fortunes can be accumulated, it is only fair to point out that the most marked successes have been achieved by men of exceptional business capacity. Their prosperity has not depended on profit sharing. Nevertheless it is satisfactory to know that men of distinguished ability have chosen this method of attaining their ends. That they have grown rich under the system is a complete answer to the objection that a man who can make a business wants to make it for himself.

Profit sharing does not, like co-operation, tend to cramp individuality. It secures to the industrial "captain" his place as leader, and the rights and emoluments which should accompany that position. The employer may be satisfied under its operation, while the worker, who has always resented his exclusion from the *prizes* of industry, may be contented also. And again, it can be so worked as to give effect to the principle of "permanent contract," instead of "temporary," between master and man. In removing the causes of discontent it should also do much to

check the impracticable, and often mischievous, scheming of socialists. Profit sharing is not a visionary scheme, it is one of those slow evolutionary processes having its beginning far back in the history of mankind, and it is admitted on all hands to be right in principle. If, however, it effects any practical improvement in the relations between the employer and the employed, it must have a fair chance. The scheme must be employed in cases where the elements of success are present, and not as a last resource to retrieve failing fortunes. To promote its adoption in Great Britain, the example of a few leading commercial men is required—men whose business is not likely to fail, and whose income is such that they can well afford to be generous if need be. To them all the compensating advantages of the system are assured, and from the experience of others there is every reason to expect that from a pecuniary point of view the venture will not prove impolitic. The system should commence amongst the more enlightened of both masters and men, and be allowed to win its way gradually. The employer should be thoroughly informed on profit sharing generally, and his particular plan should be well thought out in all its bearings. Every opportunity and every convenient agency should be utilized for explaining the benefits of the scheme to his employees; and it need hardly be remarked that no occasion is more suitable for enforcing such counsels than when they are accompanied by the tangible illustration of a bonus at the period of stock-taking. If higher motives fail, it is not improbable that the extreme irritation and worry caused by a strike and the fear of its repetition, or the desire to be remembered as a prime mover in a great industrial reform, will bring one of our prominent traders into the field, and we shall then have the scheme thoroughly tested. There is no doubt that numbers would follow a really good start. Amongst our great English traders there are many whose generous spirit has not been entirely buried in the competitive rush of the times. These will readily take up the scheme, provided they are satisfied they will not make fools of themselves, and that its general adoption will be a national benefit. The desire to be masters in the true sense, so admirably described by Mr. Ruskin, will, to all thoughtful and right-minded men, prove more potent than the vain ambition to become members of an unpopular and purposeless plutocracy.

The Waste of Raw Material in Gas Manufacture.

The London *Journal*, in an article on this subject, says that an interesting question arises out of the recent reports that have appeared concerning the working of the various oil and water gas schemes now before the public. It is with regard to the duty rendered from the raw material by different methods of gasifying solid and liquid hydrocarbons; and it will be impossible to treat the present discussions and explanations of these systems as exhaustive unless this question of their respective duty is cleared up by satisfactorily scientific handling on the part of some competent authority. What we mean by the duty of a gasification method is precisely the same as is meant by the same term when used in connection with steam power plant. And, though there is no such absolute datum in gas making as Joule's equivalent supplies to the mechanical engineer, whereby an accurate balance sheet of engine performance with relation to fuel consumption may be prepared, yet it is possible to prosecute analytical investigations of gas making systems on nearly the same lines, and with precisely the same object—to determine the loss by exchange. We know that nature does not give change without charging for the accommodation. When a known weight of coal is put into a steam boiler furnace, which is intended to convert the heating power of the fuel into the mechanical power of the engine, there is a heavy percentage of the potentiality of the coal lost in the process of transformation. Similarly, when a ton of coal is carbonized in gas making retorts, the product is a redistribution of the original atoms in the three states of solid, liquid, and gas, which, if they could all be put into the balance against the coal from which they were derived, would "kick the beam." Theoretically, the arrangement should not entail any loss of weight; but practically there is a loss, although not a very considerable one. In the manufacture of coal gas, a little apparent deficiency (say) in the weight of gas obtained may generally be ascribed to a change in the relative proportions of the other products; but, except within narrow limits, there is no room for increasing the weight of the gas at the expense of any other product. In brief, the amount of preventible waste in practical gas making is not serious, because what does not appear as gas is mostly to be found as coke, tar, and water. The most obvious waste is the carbon deposited in the retorts and hot ascension pipes, which the gas maker usually begrudges as being not only troublesome in itself, but as eminently an example of "matter in the wrong place."

We do not, at the moment of writing, recall any attempt on the part of chemist or gas engineer to determine the exact proportion of waste of the raw material which is capable of being represented as carbon deposited in retorts and pipes. It would not be an easy thing to do with any respectable degree of accuracy, even if the result were worth the labor. There is a certain interest attaching to this question of the proportion of the lost carbon in coal carbonization, however; because it rises into great prominence in connection with the carbonization of oil, which is the next raw material to coal for the manufacture of illuminating gas. All who have ever tried to carbonize oil for gas making in closed retorts, as coal is carbonized, have been confronted sooner or later with the difficulty of the wasted carbon. If oil, whether mineral or vegetable, is run into a retort and gasified, the hot surfaces on and in contact with which the process is effected are speedily coated with a deposit of carbon, which becomes graphitic if the heat is sufficient, and not only represents a serious loss of weight of material, but also prevents the satisfactory continuance of the manufacturing operations. A mineral oil which in a clean, hot retort will commence by yielding (say) 110 cubic feet of 70-candle gas per gallon will, if the process is attempted to be carried on continuously, drop in a very short time to a yield of not more than 60 or 70 per cent. of the first production, while the furnace will fail to keep the retort hot enough to prevent even worse results. If persisted in, the process would eventuate in a retort full of carbon, ranging all the way from graphite where it touched the walls, to loose, greasy soot in the centre. Gasification would have meanwhile altered to the vaporization of a constantly diminishing proportion of the raw oil, until even this would cease. The technical history of oil gas manufacture is a record of attempts to rectify this trouble, which is done in the production of Pintsch's gas by carbonizing the oil in the first stage in a metal tray placed loosely in the retort, and therefore easy to remove and clean. Notwithstanding this device, which is necessary in order that gasification may be conducted continuously in the same plant, the initial loss from deposited carbon, is, of course, constant, and averages nearly one-half of the weight of the raw material. There is a little tar produced when oil is carbonized; but this is the only true residual. The carbon thrown down in the retort is, of course, pure waste; and this waste is so great in the ordinary way of working, notwithstanding all the care that may be used to keep the retorts as clean as possible, that, as already remarked, the gas obtained scarcely weighs half as much as the oil consumed in its production.

Yet, with all its wastefulness, this was the only system of making illuminating gas from common mineral oil before the modern development of water gas was brought to a success by Lowe and his rivals and imitators. This development consists, as everybody knows, in the gasification of oil in immediate contact with the incandescent fuel of a water gas generator, or in a current of the hot gases immediately after these leave the generator. The combination is called illuminating water gas, or more shortly water gas, with the qualification of luminosity left to be understood. Let us, for the purpose of this article, however, regard the resultant gaseous mixture as an oil gas, with its illuminating power diluted, and its bulk correspondingly increased, by the addition of a non-luminous but inflammable cheap diluent. The change of standpoint will give us some fresh ideas on the general subject. From this point of view, then, we see the generator as a means of gasifying mineral oil. If preferred, the water gas can be made in a generator, and afterwards used to dilute oil gas produced in a retort. This was, indeed, the earliest system of water gas working, and the employment of a combustile diluent was a great advance on the crude practice of letting down an unmanageably rich oil gas by an admixture of air. It was evidently a further improvement when the retort was abolished, and the oil gasified upon the same glowing mass of fuel from which the diluent was obtained. If nothing else was gained by the change, the consumption of fuel for heating the retorts and the prime cost of maintenance of this portion of the old plant were saved. Were there any other advantages, however? Was the production of gas from the oil consumed improved in quantity or in quality when the operation of gasification was shifted from the closed retort to the live fuel and hot current of gas from the generator? In other words, does the modern water gas generator return a higher duty, regarded as a mass of gasifying mineral oil, than a Pintsch's retort? This is a point not fully cleared up.

The question possesses practical importance, more particularly in connection with the future of the system of utilizing oil gas in which Mr. E. Tatham (whose process was described in the *Journal* a fortnight ago) is a pioneer. For it will be observed that, although Mr. Tatham proposes to burn his rich oil gas by the aid of oxygen, instead of diluting it with water gas or anything else detrimental to the illuminating

power, he requires to make his gas first. If it is produced in the closed retort, he must submit to the loss incidental to that method of manufacture; but what if the oil is gasified on a bed of live coke? There is no necessity for the simultaneous production of a great bulk of water gas with the oil gas, but only for making just so much as may be required to prevent the oil from being burnt up in the glowing mass of fuel with such stray oxygen as may linger from the blowing up operation. It is quite possible that the duty of a generator used in this way may not be much higher than a closed retort—a suspicion that gains colors from an examination of water gas data. It appears, for example, that 3 gallons of petroleum, weighing about 25 pounds, go to the production 1,000 cubic feet of 22 candle gas. Now, if this oil were well carbonized in a clean retort, it would make 300 cubic feet of gas rated at about 70-candle power. Increasing the bulk of gas in this way therefore brings down the luminous value pretty much the same as would be the case if the lighting gas and the diluent were separately prepared. It would be satisfactory if Professor Lewes could clear up the doubt surrounding this question, by showing authoritatively how much of the weight of 1,000 cubic feet of Steenbergh water gas, as prepared under his supervision for illuminating purposes comes from the oil, which would give the ratio of loss, and how much from the coke, which would also indicate the proportion of fuel lost during the operation of "blowing up," on making producer gas. This would, in short, settle the point, now doubtful, of the comparative efficiency of retort and cupola for gasifying oil.

If it should appear, upon examination, that the wastefulness of a generator for oil is at all commensurate with that of a closed retort, it will go far to establish the deduction that the quickness with which the fluid form of hydrocarbon may be fractionally gasified, has to be paid for by an inevitable waste of carbon, which renders this form less desirable economically than the solid form, although the latter is not so tractable. It would be noteworthy if it should be shown that coal is, after all, the least wasteful form in which a gas making material is obtainable; and, from what can be learned at present, such a conclusion is distinctly probable. Oil may be so low priced in some localities that the unavoidable loss of half its weight in the process of gasification may be commercially insignificant; but the idea would nevertheless remain to iritate engineers, and perhaps to inspire inventors with vain hopes of the possibility of more economical methods.

Life and Efficiency of Electric Arc Light Carbons.

By L. B. Marks, in *The Crank*.

Ten years ago the electric arc lighting industry in this country was of little commercial importance; but a decade has seen its transformation into one of enormous proportions.

The engineer has devoted himself with assiduity to the perfection of almost every part of the electric light plant: the engine, the dynamo, the lamp mechanism—these have been experimented upon under a variety of conditions, until to-day it may be reasonably doubted that an increase in their efficiency can be more than trivial.

But there is one factor in the system which, as far as the literature on the subject goes, seems to have been relegated to a secondary position, although its prime importance in the production of a perfect light cannot be overestimated. The publication of facts concerning the laws of life and efficiency of arc light carbons has been very limited in extent, and it is the purpose of this article to briefly set forth the results of investigations made in this direction in the laboratory of Cornell University.

The conclusion has been drawn from a multitude of experiments that when the current and difference of potential between the terminals of a lamp are kept constant, with carbons of the same manufacture and type, the *life* of the carbon varies directly as its diameter and inversely as the resistance of the pencil.*

On the other hand, it has been determined† that "the *efficiency* of the carbon varies inversely as the diameter." Hence we see that invariably large efficiency is attained only at a sacrifice of life and vice versa.

Now it is found that carbons which are admirably adapted to one system of electric lighting are very inefficient when burned in another. Those systems which are operated by a small current and a long arc, as the Brush, are technically called *high tension* systems, while those which make use of a large current and a short arc, as the Weston, are known as *low tension* systems.

Recent experiments prove that, generally speaking, a *molded* carbon is superior for high tension and a *forced* for low. Forced carbons are made by pressing the crude mass through a die of given size, after the fashion of "squirting" lead pipe. But by whatever process of manufacture a carbon pencil is produced, its adaptability to a system depends mainly upon the molecular structure and conductivity of the rod.

Practice shows that "the requirement of the low tension system seems to be a carbon that is hard, and a good conductor, the latter being the more important."* In the high tension system, hardness and low resistances are undesirable. There is a tendency to burn unsteadily and "go out" when a hard pencil is used in this system, and a soft one becomes necessary.

A microscopical examination of the various types of carbons was made, in order to ascertain what relation, if any, exists between the structure of the rod and its efficiency. Transverse sections of the carbons were cut, mounted on glass slides, and viewed through a microscope having a magnifying power of 50 diameters. In each case the enlarged image of the carbon surface was photographed. A complete set of microphotographs was thus obtained, covering the principal types of forced and molded carbons now used in this country.

The study of these photos leads to the assumption that every change in the molecular structure of the carbon is accompanied by a change in the efficiency of the latter. In accordance with this statement a high tension carbon having a more compact structure than another will have a different efficiency. Similarly a low tension pencil in which the particles are symmetrically grouped in parallel ranges, differs in efficiency from one in which the striations are absent. In fact, from the relation found to exist between the structure of a pencil and its action when burned in an arc lamp, it is in many cases possible, by a simple microscopical examination, to *predict* with some degree of accuracy the efficiency of a forced or molded carbon.

The interdependence of efficiency and molecular structure is a subject about which little or nothing has been published. For the present the facts stated above must be taken for granted, as no exact law has yet been formulated. In general, however, it may be said that high efficiency with a low tension carbon is secured by a dense structure, while a loose arrangement of the particles is preferable for a high tension carbon.

It will be seen that because of the more compact structure of the forced pencil its electrical resistance is less than that of the molded rod, and hence, as was stated before, the former is better suited to a low tension system. Yet the manufacture of molded carbon for low tension plants has been and is now carried on to a large extent. Low resistance of the pencil for this purpose is absolutely essential, and although this factor is not attained by virtue of the structure, an approach to the same end is secured by thickly copper-plating the carbons.

On the other hand, in one of the manufactories of this country an attempt is made to decrease the resistance of a molded pencil by submitting the latter to great pressure in the molds. By applying a stress of 6,000 pounds per square inch the requisite density of structure is obtained.

Altering the amount of pitch in the carbon is still another method which is used for regulating the resistance of the pencil.

Summarizing we find that the difference between a high and a low tension carbon may be the result of one or more of four variations in the method of manufacture.

1st.—Variation in the direction of application of stress; e. g. "forcing" and molding.

2d.—Variation in the amount of pressure applied.

3d.—Variation in the "mix" or composition of the pencil.

4th.—Variation in the thickness of the copper coating.

Thus it appears that there is a diversity of means to the same end. The discussion of the methods employed in the manufacture of high and low tension pencils respectively can be found elsewhere.†

We have seen from the microscopical examination of the pencils and the results of actual tests that a slight difference in the molecular structure of the carbon may make a difference of several per cent. in the efficiency.

Hence, though we may fail to find a substance better suited to the purpose than the carbon point, there remains sufficient room for improvement in the manufacture of the latter.

In the foregoing remarks the direction in which this improvement must take place has been pointed out. And it is confidently hoped that in the near future the application of methods to increase the life and efficiency of the carbon will advance the electric arc light one step further towards the attainment of a perfect source of artificial illumination.

* For numerical examples see article "Arc Light Carbon," *The Crank*, p. 9, June, 1889.

† H. Nakano: "Efficiency of the Arc Lamp," *Transactions Am. Inst. Elec. Eng.*, Vol. VI., p. 308.

* G. W. Parker: *Proceedings National Electric Light Association*, Pittsburg Convention, Feb., 1888, p. 425.

† Thesis: "Arc Light Carbons"—L. B. Marks, Manuscript in Cornell University Library.

Notes on the Action of Lubricants.

Prof. J. E. Denton, in the April issue of the *Stevens Indicator*, calls attention to the action of lubricants, as observed by him:

If we "feed" oil to a journal with an ordinary cup, which has its rate of feeding restricted so that the amount of oil supplied to the journal is no greater than is common—say, on a locomotive crank-pin, or in lubricating fast-running shafting, the resistance to rotation produced by friction will be from 3 to 20 per cent. of the force or load to which the rubbing surfaces are subjected. If the rubbing surfaces are in a very smooth condition the 3 per cent. limit is realized, but in proportion as the surfaces are less smooth the friction approximates to the greater limit. The average engine bearing, which is smoothed by natural wear unattended with considerable "end play," may be assumed to create a frictional resistance equal to from 5 to 10 per cent. of the total load on the bearings—that is, the "coefficient of friction" is from 0.05 to 0.10. The idea is somewhat prevalent that modern experiments with oil-testing machines have demonstrated that a journal wears *itself*, if run for a long time without mishap, to such a condition that a coefficient of friction of a fraction of 1 per cent. is finally secured. As a matter of fact the journals of testing machines which have given such a low coefficient have been nursed by long running, under a flood of oil, to an exceptional state of smoothness, attainable only by maintaining a constant "end-play," or reciprocating motion of the brasses over a considerable fraction of the length of the journal. If such bearings are supplied with a restricted amount of oil, and the end-play motion stopped, the coefficient of friction immediately increases from the fraction of 1 per cent. to 3 or 4 per cent. In the case of railroad car bearings there is a natural realization of the low coefficients, because the supply of oil is superabundant, and there is an "end play" motion which gives to the journal and brass a highly polished surface practically unattainable on engine bearings.

Writers on lubrication for a number of years past have apparently assumed that the coefficients of friction of car service were attainable on all journals, and amongst other results of this error has been a general condemnation of the laws of friction given by the eminent scientist of the last half century, General Morin, whose work from a practical standpoint is still worthy of all respect.

Morin experimented* with shafting from about 1½ to 2½ inches in diameter, weighted with heavy pulleys or discs, so as to produce pressure up to about 200 pounds per square inch. The bearing surfaces were of cast iron, the speed about 100 revolutions per minute. The friction was measured with his well-known form of recording dynamometer. Lard oil was used and the method of feeding was made to conform to that used in practical service.

His conclusions were as follows:

Friction during motion is—1st, proportional to pressure; 2d, independent of the area of the surface of contact; 3d, independent of the velocity of motion.

It is the object of this article to show that these simple laws are still realized as nearly as is necessary for the estimation of the friction of practical machinery.

The modern theory of the action of lubricants conceives the frictional resistance to be made up of two parts—viz., a part representing the friction due to metallic contact of infinitesimal irregularities of the bearing surfaces, and a part representing the force to overcome the viscosity or fluid friction of the lubricant itself. The first part is believed to vary in direct proportion to the pressure or load on the bearings. The second part increases very slowly with the pressure. Hence the total friction, which is the sum of the two parts, may increase rapidly with the pressure if the film of lubricant is so thin as to permit considerable metallic contact, or slowly with the pressure, if the supply of lubricant is so superabundant as to practically destroy metallic contact by causing a thicker film of oil to maintain itself between the rubbing surfaces, and thereby make the principal resistance to rubbing simply the force necessary to agitate the particles of oil—*i. e.*, the force due to the viscosity of the oil.

The following tables show experimental results for these two cases. The same figures hold for any oil of about the same viscosity as lard oil. The apparatus used was a small Thurston oil testing machine with a journal 1½ inches in diameter and 1½ inches long. The same brasses were used with both the journals of Table I., but the area of bearing differed slightly.

The results of Table II. apply to both journals of Table I. The rate of feed for Table I. was determined as follows: An ordinary oil cup having a screwed needle or spindle to adjust the rate of feeding was restricted in its rate of feeding, so that when tightly closed against the atmosphere no oil would run out by gravity, but the slight suction produced by pressing the outlet against the hand and quickly withdrawing it would draw out a drop of oil.

TABLE I.—*Friction with Restricted Supply of Lard Oil.*

PART I.—*Hardened Steel Journal-Composition Brasses.*					PART II.—*Soft Steel Journal-Composition Brasses.*				
Pressures in Pounds		Coefficients of Friction.		Temp. Fahr. Degrees.	Pressures in Pounds.		Coefficients of Friction.		Temp. Fahr. Deg.
Per sq. in.	Total on Bearings.	300 Revs. per Min.	900 Revs. per Min.		Per sq. in.	Total on Bearings.	300 Revs. per Min.	900 Revs. per Min.	
40	88	0.050	0.047	102	13	26	0.070	0.10	100
65	136	0.055	0.050	102	50	100	0.056	0.076	100
115	236	0.054	0.055	102	100	200	0.058	0.075	100
215	436	0.051	0.063	102	200	400	0.060	0.075	100

TABLE II.—*Friction with Superabundant Supply of Lard Oil.*

Pressures in lbs.		Coefficients of Friction.		
Per Sq. Inch.	Total on Bearings.	300 Revs. per Minute.	900 Revs. per Minute.	Temp. Fahr., Degrees.
13	26	0.060	0.100	100
50	100	0.038	0.053	I00
100	200	0.032	0.027	100
200	400	0.045	0.024	100

When the cup was screwed into the upper brass of the machine, the suction,* due to the revolution of the testing journal, would draw out sufficient oil to satisfactorily lubricate the bearings. To produce the superabundant feed for Table II., the adjusting needle was removed from the cups and the latter left open at the top to the atmosphere. Thereby the oil was free to flow to the journal through a hole ¼ inch diameter under two inches of head. The rate of consumption under these circumstances was about a pint per hour. The consumption in the case of Table I. could not be discerned in less than several days' usage. From the inspection of Table I., it is evident that the friction practically follows the laws of Morin, the cofficient being constant for pressures above about 40 pounds per square inch, and so nearly independent of the speed that exceptions to this rule are ascribable to differences of condition of bearing surfaces, and the margin of error in the determinations—about 10 per cent.

A study of Table II., shows. 1st: that while the friction at the light pressures approximates to that given in Table I., for pressures above 40 pounds per square inch, it is considerably less for the superabundant supply; and, 2d, that the friction does not increase proportionally to the pressure, but follows an irregular law evidently depending upon the speed.

Thus, for 300 revolutions the coefficient first decreases and then increases as the pressure changes from 100 to 200 pounds, whereas, at 900 revolutions there is a continued decrease of coefficient. The apparent irregularity is, however, interestingly in accordance with the theory of friction outlined above. Thus, at 13 pounds pressure the coefficient of friction is 50 per cent. greater at 900 revolutions than at 300, because at both speeds sufficient thickness of film is maintained to make the portion of the friction due to viscosity preponderate very largely over that due to metallic contact. The same conditions also apply to the figures at 50 pounds pressure.

But at 100 and 200 pounds pressure, the difference in the suction effect of the two speeds in drawing oil between the rubbing surfaces, evidently makes so much difference in the thickness of the film of oil, that *the decrease in friction due to the less degree of metallic contact at high speed, preponderates over the increase of friction due to viscosity. Hence, increase of speed produces exactly the opposite effect upon the coefficient of friction at the higher pressures that it does at the lower pressures.* The absolute value of the pressure at which this change of effect takes place would, of course, differ with such variations of proportions and arrangement of journals and feeding orifices as would modify the suction effect due to velocity of rotation.

In practical service the only bearings which receive a supply of oil approximating to that used for Table II., are car journals when freshly supplied with oil and dynamo bearings for which the oil is filtered and repeatedly reapplied.

Steam engine and general machinery lubrication realizes the conditions of Table I.

*"Fundamental Ideas of Mechanics," by Arthur Morin, Arts, 230-255

*This method of adjusting the rate of feeding is common in lubricating shafting and locomotives, etc. The oil is thereby consumed at as slow a rate as is grease, and affords excellent lubrication.

In a succeeding article it will be shown that Morin's laws, if applied to the calculation of the friction of steam engines, afford results in satisfactory agreement with prony brake determinations of this friction.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Sioux City (Ia.) Gas Light Company's amended rate schedule became operative on the 1st inst., and cannot fail to produce a marked effect on the sendout. The prices now in force are:

Monthly Consumption.	Net Rate per 1,000.
Under 5,000 cu. ft.	$1.90
5,000 to 10,000 cu. ft.	1.80
10,000 to 25,000 cu. ft.	1.70

On all gas used for purposes other than illumination, to be registered on a separate meter, the net rate is $1.50 per 1,000, but all gas bills unpaid 10 days from date of presentation will thereafter be reckoned on the basis of a charge of $2 per 1,000.

THE franchises and plant of the Decatur (Ala.) Gas Light Company have been sold by the New York Contract Company to Decatur capitalists The latter have determined to extend the main system to North Decatur.

IN mid-April the employees of the Elizabethtown (N. J.) Gas Light Company notified Superintendent Engel that unless an increase in pay (it figured out something like a 12½ per cent. raise all round) was granted them by April 23d, a strike would be ordered. Manager Kean refused—and properly so—to accede to the modest (?) demands of his force, whereupon the men "went out." The Company had no difficulty in securing the necessary substitutes.

THE Hon. Wilbur F. Lunt, as attorney for the Biddeford and Saco (Me.) Gas Company, has commenced an action against the city authorities of Biddeford to recover $5,000 damages for injuries to mains and wastage of gas, traceable to the careless operations of the city's street department.

THE following common-sense circular has been issued by the proprietors of the Van Wert (O.) Gas Light Company to the residents of that city:

"Ten years ago gas was first turned into the mains of this Company. During that time there has not been a single night that gas has not been furnished to our patrons. Occasionally the service has not been as perfect as we could desire, but these occasions have been rare, and the causes thereof have been removed, so that we now feel safe in assuring our consumers that the liability for suspended or defective service has been reduced to the minimum. Our business has had a continuous and healthy growth and has never been on a more satisfactory basis than the present time. In view of this fact we have adopted a new discount schedule which will materially reduce the net price of gas on monthly bills of over 1,000 cubic feet. The gross rate of $2 per 1,000 will be maintained, and all discounts will strictly depend on the prompt payment of bills. All gas passing through any one meter, after May 1st, 1890, will be subject to the following discounts:

Monthly Consumption	Discount, per Ct.	Net Price.
1,000 cu. ft. or less	10	$1.80
1,000 to 3,000 cu. ft.	15	1.70
3,000 to 5,000 "	20	1.60
5,000 to 10,000 "	25	1.50
10,000 and upwards	(Special.)	

In dealing with several hundred customers it is impossible to make repeated calls in collections. One call will be made at the place of business or residence of each consumer. Bills not then paid must be sent to our office on or before the 10th of the month succeeding the month of consumption, otherwise the gross price will be collected. We urge consumers to frequently read their meters, minute instructions for which are printed on the reverse side of monthly bills. We shall at all times be glad to give any other explanation or information. The meter is the *arbiter* between the Company and the consumer. It is constructed on scientific principles, and is supposed to measure correctly. It is as much the standard of measurement as the merchant's scales; it is owned by the Gas Company, and is on the premises of the consumer; neither could tamper with it if he would. Using the best methods and material known to modern gas making, we cannot but feel that we are furnishing a superior article. Should there be any cases of defective service the cause will be found to be local, and we shall desire to be informed of such cases and to be consulted towards proper remedies. We thank our customers for past patronage and assure them of our desire to continue to serve them well and faithfully. By good service, square dealing, courteous attention and prompt response to complaints, we hope to merit and obtain a large increase of business."

THE Easton (Pa.) Gas Company will soon be out with an announcement of cheaper rates.

THE Davis & Farnum Manufacturing Company have quite a number of contracts on their ledgers, and the probability is that several other plums are about to come their way. Among the list we note the following: An iron roof and ten benches of 6's (complete) for the new retort house of the Lowell (Mass.) Gas Light Company; a double-lift holder (capacity 200,000 cubic feet) to be put up in Malden for the Malden and Melrose (Mass.) Gas Light Company; a single-lift holder (capacity 100,000 cu. ft.) for the Gloucester (Mass.) Gas Company; a tank (35 ft. by 19 ft.) for the Providence (R. I.) Company; and alterations to the benchwork of the Nassau (Brooklyn, N. Y.) Gas Company. These items, together with their general run of work on water works and sugar houses, including flanged pipe, gas and water pipe, specials, etc., ought to keep Treasurer Farnum and Traveler Davis on the go this summer.

THE following is the summary of the results of the annual meeting of the Chicago Gas Trust Company, held at the Company's office, 101 Lake street, on the afternoon of April 24th. Among the prominent out-of-town stockholders present were Vice-President Benedict, of this city, Chas. F. Dietrich, E. J. Jerzmanowski, P. A. B. Widener and W. L. Elkins; 206,325 shares out of the 250,000 were represented. Perfect unanimity of thought and expression prevailed, and each vote was unanimous. The supplementary deed of trust transferring the stock of the four Companies in the Trust to the Fidelity Insurance Trust and Safety Deposit Company, of Philadelphia, by the Board of Directors, was ratified, as was also a proposition to change the name of the corporation to that of the Chicago Gas Company. The Directors chosen were: Messrs. W. H. Gebhard, E. C. Benedict, R. M. C. Graham, H. J. Davison, Chas. F. Dieterich, John Sloane, E. J. Jerzmanowski, C. R. Cummings, S. A. Kent, N. K. Fairbank, W. L. Elkins, P. A. B. Widener and C. K. G. Billings. The officers chosen were: President, C. K. G. Billings; First Vice-President, E. C. Benedict; Second Vice-President, E. J. Jerzmanowski; Secretary, T. B. Wells; Assistant Secretary, C. K. Wooster.

AS was intimated in the last issue of the JOURNAL, the Citizens Gas Light Company, of Newark, N. J., has notified its meter setters to remove all meters from stores and residences where the electric light has superseded gas. A general howl along the line is the result; but it is quite certain that the parties affected will either have to agree to burn a certain quantity of gas per month, or else pay a meter rental.

THE Girard (Kansas) Gas and Electric Company has been incorporated by O. T. Boaz, J. A. Bendure, J. T. Leonard, S. P. Christian and Austin Hawley. It is capitalized in $25,000. This place is the capital of Crawford county, Kansas, and is on the Missouri River, Fort Scott & Gulf Railroad, at a point 26 miles south by west of Fort Scott. It is also connected by rail with Joplin, Mo. Coal of fairly good quality is mined there. Population, about 6,200.

THE American Gas and Ventilating Machine Company, with principal offices at Auburn, Me., has been incorporated with a capital of $500,000. The business to be prosecuted is the manufacture of machines for compressing air and generating gas. Its officers are: President, Geo. H. Barrows, of Somerville, Mass.; Treasurer, Wm. P. Hammond, Charlestown, Mass.

ON and after May 1st the offices of the St. Paul (Minn.) Gas Light Company will be in the handsome building of the New York Life Insurance Company, corner 6th and Minnesota streets, that city.

THERE was a lively contest this year at Paducah, Ky., for the public lighting of that city, which is not to be wondered at when it is remembered that the successful bidder would have the work until 1894. The bidders included the Thomson-Houston Electric Arc and Incandescent Company, the Excelsior Electric Company (arc), the Ohio Gasoline Street Lighting Company, and the Paducah Gas Light and Coke Company. Mr. H. W. Meyers, Superintendent of the latter Company, seems to have convinced the Council that gas was not only the light of the present, but was to remain the light of the future—for four years at any rate—for his Company was awarded the contract to maintain 300 gas lamps (5-ft. burners), moon schedule, on the basis of a gas rate of $1.25 per 1,000 cubic feet. Twelve of the City Fathers were present, and 11

of them voted for gas. The Paducah Company's rates are: For public uses, $1.25 per 1,000; for illuminating (private) purposes, $1.75; for cooking, heating, and power uses, $1.50. Supt. Meyers will put down 3 miles of new street mains this season. He is a good one.

We are in receipt of a handsomely printed circular sheet containing the names of no less than 112 housekeepers of East Saginaw, Mich., who are using either gas stoves, ranges, fires, etc., furnished by the Gas Company of that city. This of itself would look "numerous enough" to fully testify to the fact that gas as a cooking and heating agent is away above par in the locality noted. Supt. G. A. Hyde, Jr., however, to whom we suppose the credit of compiling such an effective advertising method is due, clinches this testimony in the remark that the list is but a partial one. Well, he ought to have success; for it took some courage to put the cooking and heating gas rate in a place like East Saginaw at $1 per 1,000. He is a son of his father, and no mistake.

Some days ago the Wabash Railway Company entertained by invitation a select party, for the purpose of showing its guests how well the Pintsch system of compressed gas lighting answered for the ordinary illumination of a swiftly moving train. The trial train was made up of 5 coaches, and the trial trip covered 50 miles. The affair was most successful.

At the annual meeting of the Ottawa (Can.) Gas Company the financial reports rendered were indorsed as satisfactory by the shareholders. The officers chosen were: Directors, Robt. Blackburn, Senator Clemow, S. Howell, Thos. Patterson, Jas. McLaren, and Allan Gilmour. President, Robt. Blackburn; Managing Director, Senator Clemow; Secretary and Treasurer, Alex. Spittall.

At a meeting of the Board of Directors of the Charleston (W. Va.) Gas Light Company, it was ordered that the President (Mr. Frank Woodman) of the Company be authorized and directed to take immediate steps to erect an electric light plant, for arc and incandescent lighting, under the authority conferred by the charter of the Company, of such capacity as he may upon investigation approve; and to advertise for bids for same.

Some time ago we noted the formation of a gas company for Fort Benton, Mich., to which we may add that the concern bears the title of the Excelsior Gas Company. The proprietors have determined to install a water gas plant, which will be completed and put in operation as soon as possible.

Mrs. Annie Riley, through Messrs. Doherty & Doherty, has taken an action, *in forma pauperis*, for $5,000 damages against the Montreal Gas Company. The declaration states that plaintiff's husband, John Riley, who was a stoker in defendant's employ, when coming out of the workshops, at an early hour in the morning, fell into an excavation in the yard and sustained injuries that eventuated in his death.

The people of Windsor, Ont., are to vote on a proposition empowering the local authorities to invest $15,000 in an electric lighting plant, to be operated on municipal account.

Mr. Jno. Cabot's specialtes in trays for gas works still hold the market. The Church grooved slat tray for iron oxide is a great success.

The proprietors of the Joplin (Mo.) Gas and Coke Company are out with an announcement of cheaper gas, the concession to affect all gas consumed from first inst. Under its terms the gross rate is cut from $2.50 to $2 per 1,000, and prompt payment—*i. e.*, accounts must be settled 8 days from presentation—secures the following rebates:

Monthly Consumption.	Discount per Cent.	Net per 1,000.
Under 5,000 cu. ft.....	5 "	$1.90.
5,000 to 7,500 cu. ft.....	10 "	1.80.
7,500 to 10,000 cu. ft.....	15 "	1.70.
10,000 and over.....	20 "	1.60.

Where a separate meter is placed for the registration of fuel gas, a net rate of $1.50 per 1,000, irrespective of monthly consumption quantity, is operative; but a meter rental of 25 cents per month is charged. This latter item seems to us to be in line with imperfect policy, and we hold to the opinion that the consumers would be better satisfied were they called on to pay the $1.60 per 1,000, without the rental feature. The company maintains a handsome assortment of cooking and heating appliances, which it disposes of at net cost. One excellent feature of the Joplin cheap gas announcement is, that it is made to take up about one-quarter page of one of the local dailies; and it is printed in such a bold manner that one is led to exclaim, "Well, the Joplinite who cannot read that while in motion, must be a very swift runner."

The case of Roland H. Smith *vs.* the Pittsburgh Gas Company, was decided about a fortnight ago, in an opinion filed by Judge Acheson, who upholds defendant. In general terms the suit was for infringement of letters patent (granted November 17, 1885, to Smith,) for a process of producing illuminating gas. Judge Acheson's opinion, which is a very lengthy one, goes into the merits of the case with great minuteness, and the summing up is as follows: "I do not see how it can be denied that the process practiced at Beaver Falls was the same as that described in the Smith patent, and was an anticipation. What more does the patent disclose than was there known and prosecuted? As to the proper proportions in the admixture of the natural gas and the fluid hydrocarbon the patent is silent. It gives no instance whereby the excessive employment of the enriching agent may be avoided. Nor can the transaction at Beaver Falls be deemed an unsuccessful and abandoned experiment within the meaning of the patent law. An illuminating compressed gas was there actually produced, and for a long time was extensively used. The cessation of the use was not because the product was impracticable, but by reason of the unsatisfactory nature of the product, in that the compressed gas burned with a smoky flame. And here it must be observed that there is testimony in the case tending very strongly to show that smokiness is a defect inherent in gas produced by combining natural gas and petroleum gas, for the reason that natural gas is deficient in hydrogen. I will not, however, discuss that subject. It is enough here to say that in my opinion the defence of anticipation has been made out."

The Kentucky State Senate has granted the Louisville Gas Company the right to manufacture and distribute electrical currents for lighting and power purposes. We might also note that the Senate Committee, appointed to investigate the charges of corrupt interference by the Company in municipal and State elections, was, upon request of its Chairman, Senator Poyntz, discharged from further service in that direction. Thus ends the investigation farce, which termination might lead one to exclaim: "What were they (the Committee) born for, when they were so soon done for?"

The proprietors of the Inter-State (St. Louis, Mo.) Gas and Water Works Company have agreed to include the "erection, management and maintenance of electric light plants" in the objects for which the Company was originally chartered to uphold.

The Village Trustees of Glens Falls, N. Y., have awarded a 3-year contract for the public lighting of that place to the Glens Falls Electric Light and Power Company, at its bid rate of 26 cents per arc per night, on an all-night schedule. Much dissatisfaction exists over this determination, because another and lower bid for the service, from the Glens Falls Gas Light Company, was entirely disregarded. The contract for the naphtha lighting was awarded to the New York and New Jersey Globe Gas Light Company at its bid of 7 cents per lamp per night.

The Committee on Manufactures, of the Massachusetts Legislature, have presented a report in the matter of their investigations at Alexandria and Richmond, Va., and Philadelphia, as to the operation of gas and electric lighting plants by municipalities. The Committee considered it inadvisable to recommend the adoption of municipal control of gas and electric light works in the cities and towns of Massachusetts. In Richmond, they say, it is evident that a limited number of citizens are paying a high price for gas without corresponding advantages to the city. As to Philadelphia, they say, if the offer of $1,200,000 rental and 17,000 street lights free had been accepted, the city would certainly get its gas as cheaply as it does now, and instead of an actual loss of $104,145, would have an actual profit of $1,851,000.

It is said that the Fahnehjelm Incandescent Gas Light Company will attempt to secure a fuel gas charter for Rockford, Ills.

The sales of gas at Atlantic City, N. J., during the month of March amounted to 3,000,000 cubic feet, which is an increase of about 25 per cent. over the quantity consumed in March, 1889.

Mr. Alex. L. McKaig, of the Fuel Gas and Electric Engineering Company, of Pittsburgh, Pa., is to be married to a Miss Rogers, of London, England. The ceremony will take place in June.

Mr. H. P. Talmage, of Netherwood, a suburb of Plainfield, N. J., has been lighting his mansion on Belvidere avenue with gas produced

from some type or another of an automatic gas machine. He will probably resort to other means of obtaining artificial illumination, as the apparatus "exploded, with a loud report," on the evening of Sunday, April 20.

SUPT. EVANS, of the Spencer (Mass.) Gas Company, is using Lima crude oil for enriching purposes.

IN a recent issue of a St. Louis newspaper we find the following: "Gas bills to private consumers for the month of April," said Mr. J. D. Thompson, Vice-President of the Laclede Gas Light Company, "will be made out at $1.25 per 1,000 cubic feet. It will be time enough to reduce the rate to 90 cents when the court of last resort decides that we must do so. The Carondelet Company will probably charge what it has been charging right along, $2 per 1,000. The Carondelet Company is not a large one, and the bulk of its business, probably, is in the supply of gas to the public lamps."

IN respect to the petition of the Laclede Company for an injunction restraining the city of St. Louis from attempting to enforce the provisions of the 90 cent gas ordinance, we have the following advices: The Laclede Gas Light Company has anticipated the city in the litigation to test the validity of the new gas ordinance fixing the price of gas at 90 cents per 1,000 cubic feet, and which went into effect on March 10 last, by commencing an injunction suit in the Circuit Court to restrain the city from enforcing the new ordinance. The Gas Company, with Gibson, Bond & Gibson, Boyle, Adams & McKeighan, and Lubke & Muench as attorneys, filed a petition in the Circuit Court about a fort night ago, asking the court to declare the ordinance invalid and of no effect, so far as the Laclede Company is concerned, and to enjoin the city from attempting to enforce it. The petition sets out the incorporation of the Laclede Gas Light Company by the General Assembly of the State of Missouri, by an Act approved March 2, 1857, and an amendatory Act approved March 26, 1868; that the Company under the grants thus given it has laid 135 miles of pipe, has a large and valuable plant, and has been supplying gas to consumers, and that this right is in no manner dependent upon or subject either in respect to the right of vending gas or the price at which it shall be vended, or in the manner of collecting its bills for gas consumed, to any control, legislation, supervision or dictation on the part of the city or any of its officers, agencies or instrumentalities.

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No one will doubt that gas made in the Siemens producer may be enriched by the addition of water gas (hydrogen and carbonic oxide free from nitrogen), and that by using such enriched gas in the Siemens furnace a higher temperature may be obtained than by using producer gas alone; but it may be questioned whether this can be done profitably, both as regards cost of fuel and wear and tear of furnaces.

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The *Engineering Record* says that while the question of steam discharge through orifices has been ably investigated from a theoretical standpoint, there is a lamentable deficiency of experimental data on the subject. The following table, calculated for steam pressures ranging from 10 to 150 pounds per square inch above the atmosphere, will therefore prove valuable. It has been calculated by means of a formula given in a Report on Safety Valves in the Transactions of the Institution of Engineers and Shipbuilders in Scotland, and stated to agree with the results of experiments for pressures not lower than 10 pounds per square inch with a surprising degree of exactness:

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Gauge Pressure.	Velocity of Discharge in Feet per Second.	Pounds of Steam Discharged per Minute per Sq. In. of Opening.	Gauge Pressure.	Velocity of Discharge in Feet per Second.	Pounds of Steam Discharged per Minute per Sq. In. of Opening.
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15	867	26.6	75	895	77.6
20	871	30.9	80	896	81.9
25	874	35.3	85	898	86.0
30	877	39.5	90	899	90.3
35	880	43.8	95	900	94.4
40	882	48.0	100	902	98.6
45	884	52.3	110	904	106.9
50	886	56.5	120	906	115.2
55	888	60.7	130	908	123.5
60	890	65.0	140	910	131.9
65	892	69.3	150	912	140.2

For obvious reasons no table can be calculated for the flow of steam through pipes since the element of pipe length there must be considered, and no two cases in practice would have the same length of pipe. In Robert Briggs' "American Practice in Warming Buildings by Steam," however, extensive tables are given for different conditions, to which it may be interesting to refer.

An Ingenious Device for Lighting the Bottom of the Sea.

In the investigations that were undertaken by the Prince of Monaco in deep sea soundings, an ingenious method was adopted to obtain specimens of the living creatures existing at the bottom of the ocean. The apparatus used was shown at the Paris exhibition. The cage in which the submarine animals were caught, according to *Le Genie Civil*, consisted of a cylinder of wire having three conical entrances, like those of a lobster pot, and weighted for submersion with detachable weights. It was, however, very unlikely that at these immense depths, where the darkness is practically total, any fish would voluntarily find their way into the trap, and steps were taken to attract them by a light placed inside it. Obviously, no light was available but an electric light, but to get an electric light to burn a mile or two under water was not easy.

The only resource was to supply the incandescent wire from a battery in the trap. Here, however, another difficulty occurred. It was necessary to enclose the battery, which had to be of considerable power, in a box of some kind, and as the hydrostatic pressure at such depths was six or seven hundred pounds to the square inch, it was found impossible to make a box which was not crushed before it reached its destination. At last, however, this trouble was overcome by the curious device of connecting the box with a balloon. The balloon was made of cloth dipped in indiarubber, and so arranged that the air in it was in communication with that in the battery box.

On sinking the apparatus, the hydrostatic pressure, being virtually uniform all round the balloon, compressed it equally on all sides, forcing the air out of it into the battery box, until the pressure inside the box and balloon exactly balanced the pressure outside. This process went on to any extent, so that at the bottom of the sea, although the balloon was reduced by the enormous force exerted on it to a small fraction of its original size, it still kept the internal and external pressure equal. On raising the apparatus again it expanded as the pressure diminished, and brought the battery box to the surface uninjured. So successful was this device that, not content with capturing deep-sea fish, the prince and his assistants propose on their next expedition to send down a photographic apparatus and bring back negatives of the bottom of the ocean, as seen by the electric light.

from some type or another of an automatic gas machine. He will probably resort to other means of obtaining artificial illumination, as the apparatus "exploded, with a loud report," on the evening of Sunday, April 20.

SUPT. EVANS, of the Spencer (Mass.) Gas Company, is using Lima crude oil for enriching purposes.

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25	874	35.3	85	898	86.0
30	877	39.5	90	899	90.3
35	880	43.8	95	900	94.4
40	882	48.0	100	902	98.6
45	884	52.3	110	904	106.9
50	886	56.5	120	906	115.2
55	888	60.7	130	908	123.5
60	890	65.0	140	910	131.9
65	892	69.3	150	912	140.2

For obvious reasons no table can be calculated for the flow of steam through pipes since the element of pipe length there must be considered, and no two cases in practice would have the same length of pipe. In Robert Briggs' "American Practice in Warming Buildings by Steam," however, extensive tables are given for different conditions, to which it may be interesting to refer.

An Ingenious Device for Lighting the Bottom of the Sea.

In the investigations that were undertaken by the Prince of Monaco in deep sea soundings, an ingenious method was adopted to obtain specimens of the living creatures existing at the bottom of the ocean. The apparatus used was shown at the Paris exhibition. The cage in which the submarine animals were caught, according to *Le Genie Civil*, consisted of a cylinder of wire having three conical entrances, like those of a lobster pot, and weighted for submersion with detachable weights. It was, however, very unlikely that at these immense depths, where the darkness is practically total, any fish would voluntarily find their way into the trap, and steps were taken to attract them by a light placed inside it. Obviously, no light was available but an electric light, but to get an electric light to burn a mile or two under water was not easy.

The only resource was to supply the incandescent wire from a battery in the trap. Here, however, another difficulty occurred. It was necessary to enclose the battery, which had to be of considerable power, in a box of some kind, and as the hydrostatic pressure at such depths was six or seven hundred pounds to the square inch, it was found impossible to make a box which was not crushed before it reached its destination. At last, however, this trouble was overcome by the curious device of connecting the box with a balloon. The balloon was made of cloth dipped in indiarubber, and so arranged that the air in it was in communication with that in the battery box.

On sinking the apparatus, the hydrostatic pressure, being virtually uniform all round the balloon, compressed it equally on all sides, forcing the air out of it into the battery box, until the pressure inside the box and balloon exactly balanced the pressure outside. This process went on to any extent, so that at the bottom of the sea, although the balloon was reduced by the enormous force exerted on it to a small fraction of its original size, it still kept the internal and external pressure equal. On raising the apparatus again it expanded as the pressure diminished, and brought the battery box to the surface uninjured. So successful was this device that, not content with capturing deep-sea fish, the prince and his assistants propose on their next expedition to send down a photographic apparatus and bring back negatives of the bottom of the ocean, as seen by the electric light.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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MONDAY, MAY 5, 1890.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.
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MAY 5.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	99	—
Central	500,000	50	85	95
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	117	119
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	120
Mutual	3,500,000	100	109	112
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	45
Preferred	5,000,000	100	84	87
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	115	120
Citizens	1,200,000	20	68	70
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	125	130
" Bonds	300,000		100	105
Peoples	1,000,000	10	84	88
" Bonds (5's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	100	104
Nassau	1,000,000	25	120	—
" Ctfs	700,000	1000	100	102
Williamsburgh	1,000,000	50	123	125
" Bonds	1,000,000	—	110	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	93	93½
2d " " "	3,000,000	1000	71	72
Bay State Gas Co.—				
Stock	5,000,000	50	23½	25
Income Bonds	2,000,000	1000	—	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds.	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	51¾	52
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	100	95¼	95½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	94⅞	95½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	96	100
Consumers Gas Light Co., Jersey City	2,000,000	100	20	—
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	6,000,000	100	201	203
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			80	90
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	49	49¼
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	75	90
Bonds	250,000		—	—
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	170	175
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	19⅛	19¼
Preferred "	2,500,000	100	—	—
Bonds	9,034,400	1000	84	84¼
Louisville, Ky	2,570,000	50	125	130

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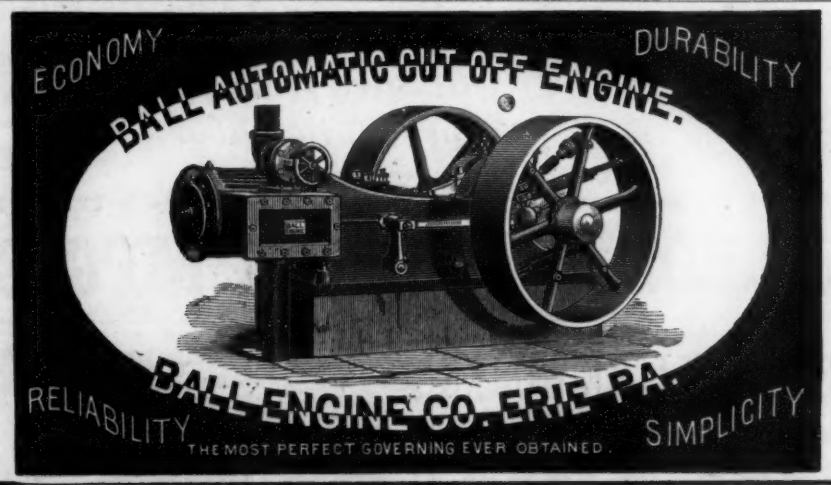

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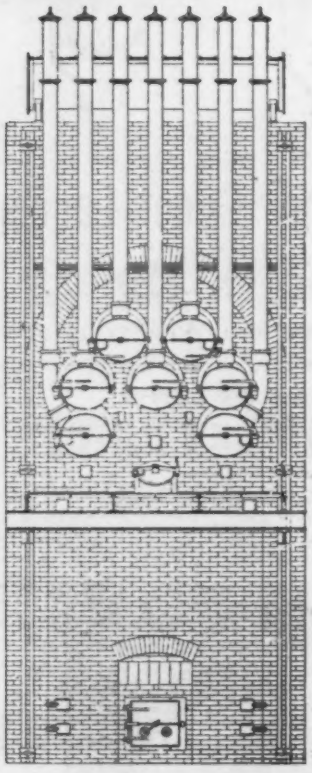

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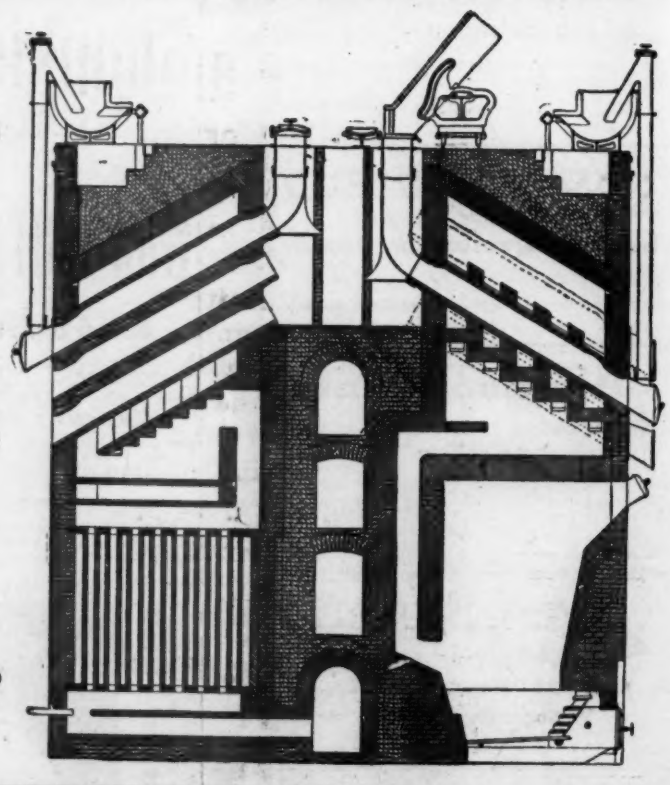

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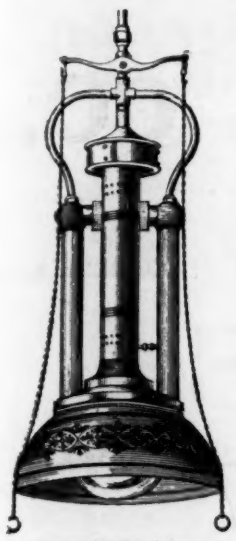
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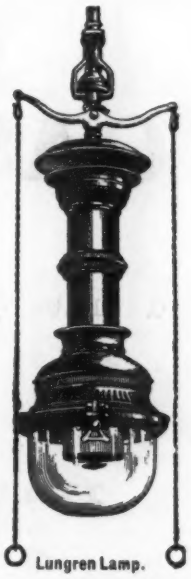
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Amsterdam	1,500,000
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Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
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"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" " Citizen	500,000
Brookline, U.S.A	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A	1,000,000
"	1,000,000
" Nassau	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A	350,000
Denver, "	500,000
" "	1,000,000
Dusselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z	400,000
Darlington	1,250,000
Detroit, U.S.A	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	560,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A	430,000
Newmarket	150,000
Newark, U.S.A	680,000
Northfleet	200,000
New York, U.S.A	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	150,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A	250,000
Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland	1,500,000
St. Josephs, U.S.A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A	2,000,000
"	2,000,000
Sheepbridge Coal Co.	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A	750,000
Toronto	1,000,000
Uxbridge	300,000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
Williamsburg, U.S.A	600,000
"	600,000
Wellington	150,000
Warwick	300,000
Wheeling, U.S.A	500,000
Walker	300,000
Westgate	100,000
Wilmington, U.S.A	500,000
Windsor, N. S. W.	100,000
Wolverton	100,000
Wellington, N. Z.	250,000
Whitchurch	175,000
Washington, U.S.A	2,000,000
Wallasey	750,000
Weimar	150,000
Wurzen	200,000
Worcester, U.S.A	750,000
Yeadon	500,000
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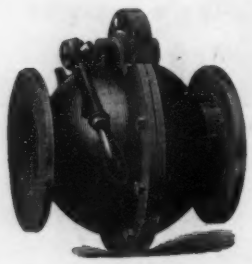

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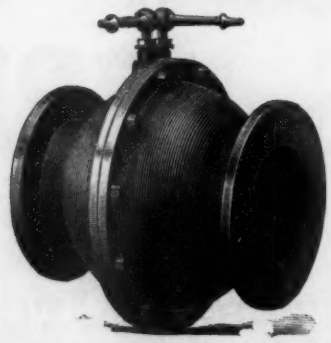

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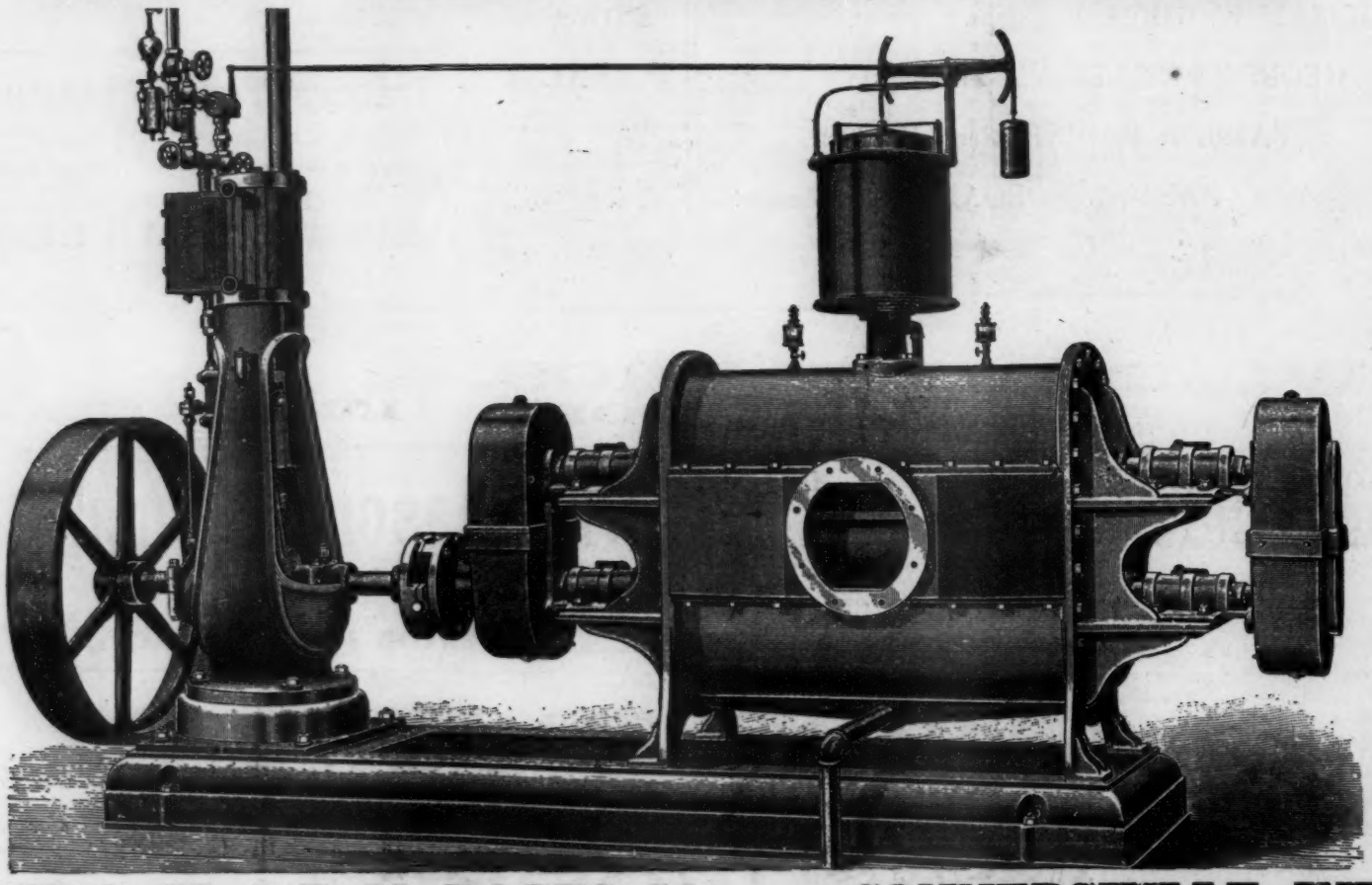

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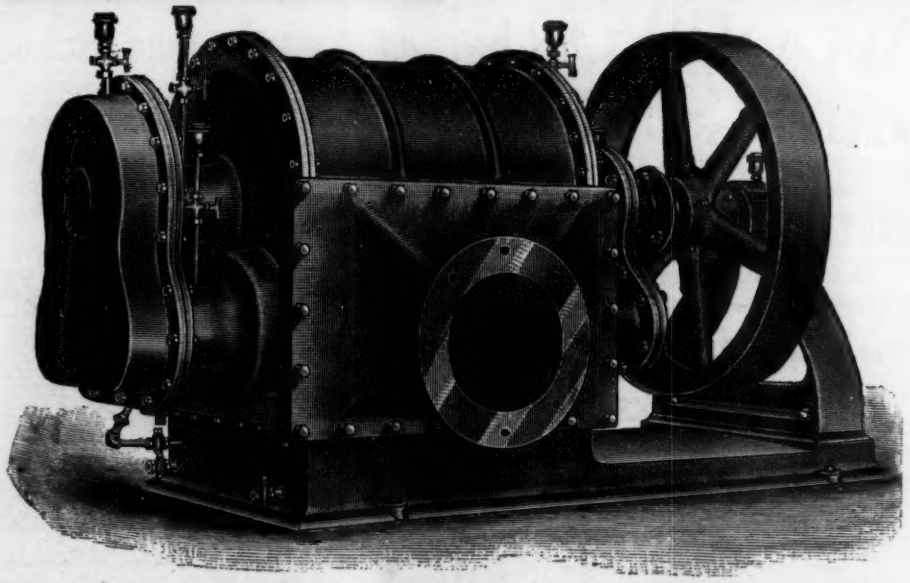

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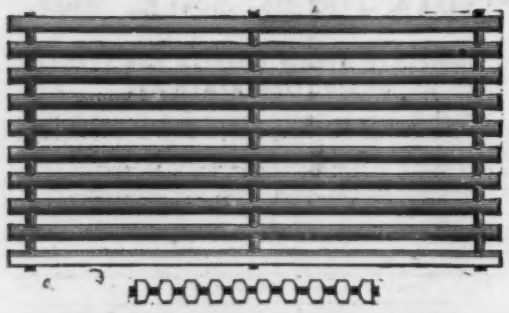

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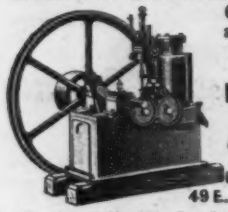

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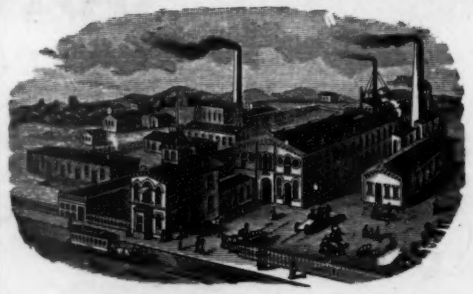

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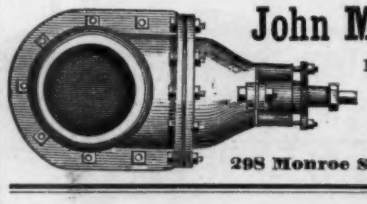

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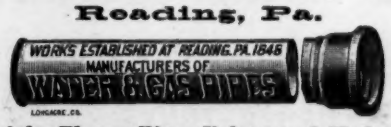

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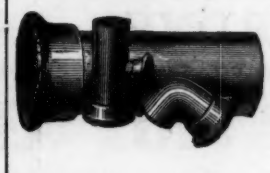

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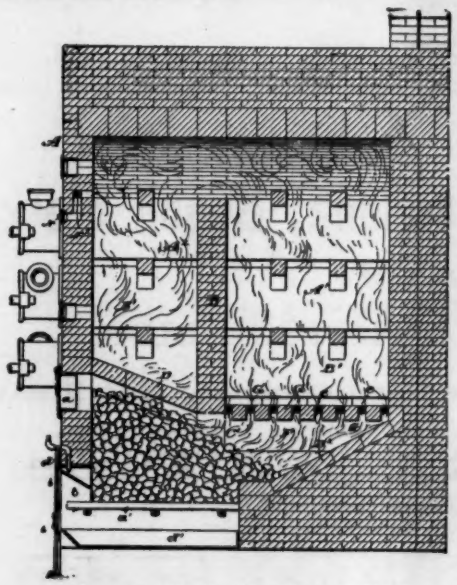

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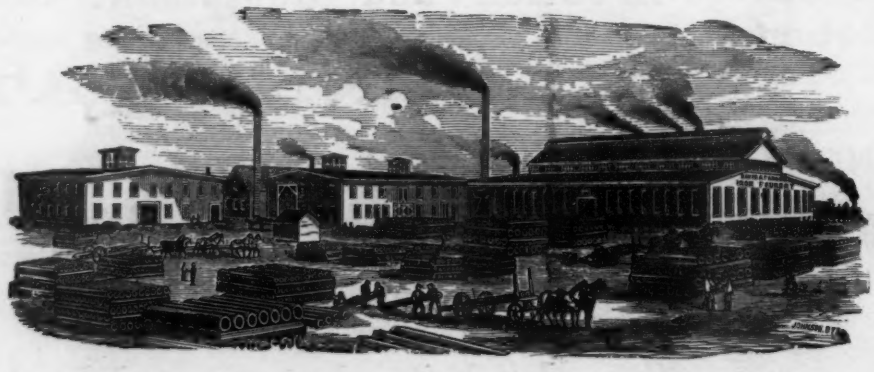

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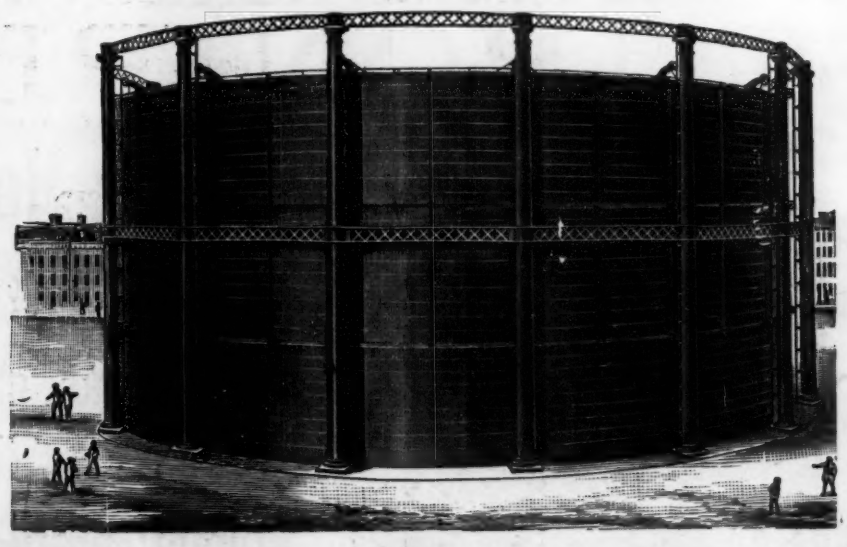

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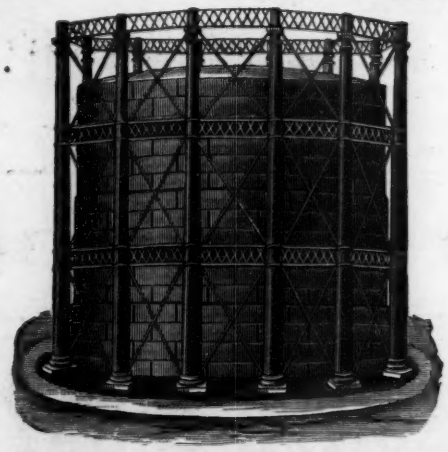

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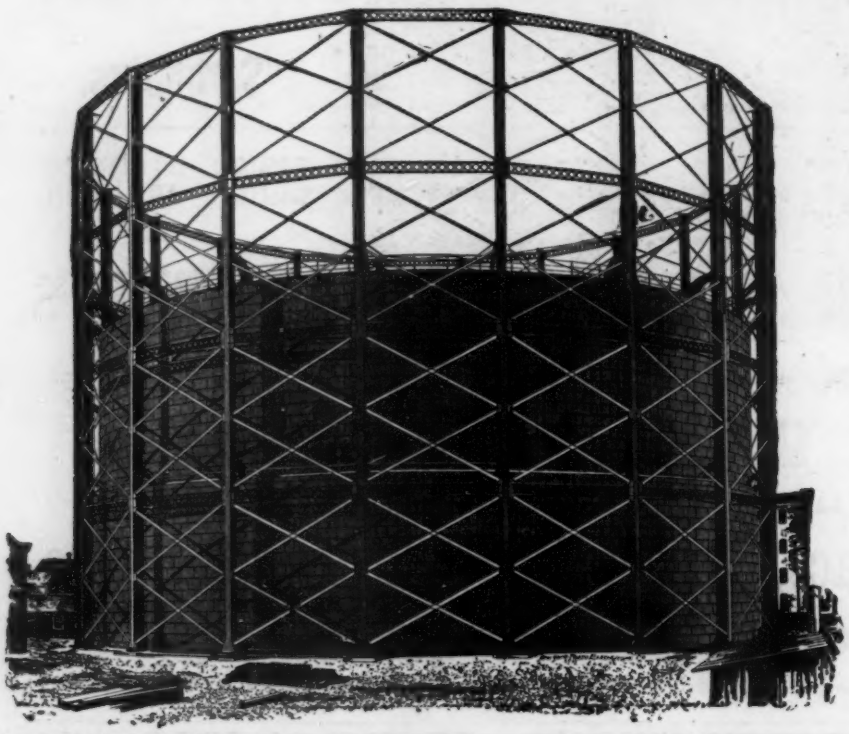

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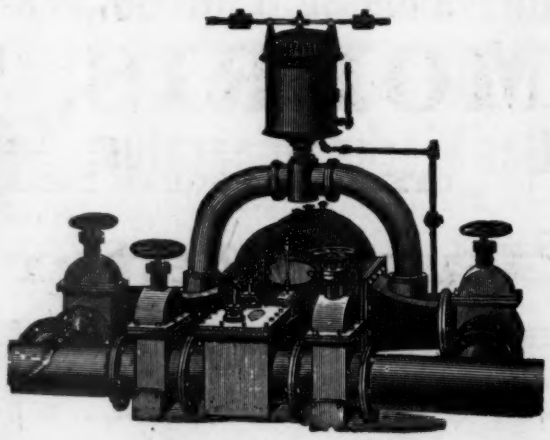

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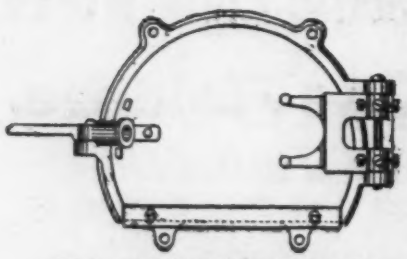

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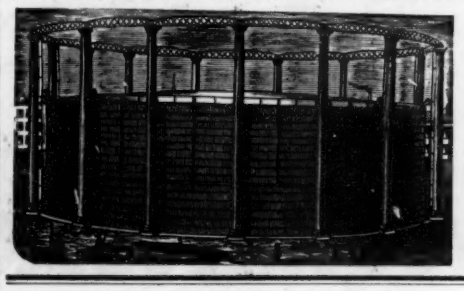

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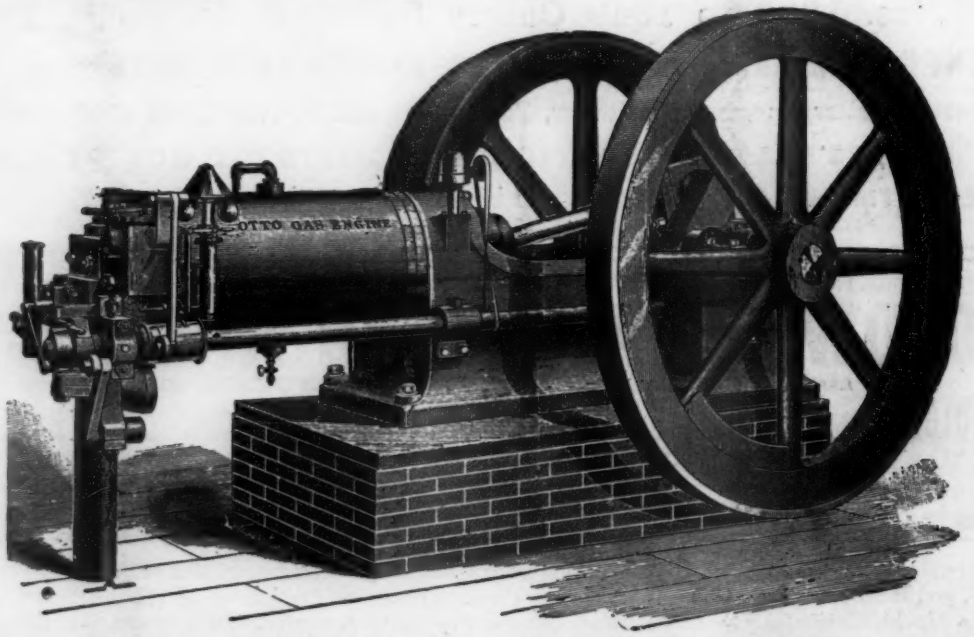

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